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SHAKESPEARE SELF-DRAWN.

By "BENVOLIO."

"LOVE'S LABOUR'S LOST."

IN regard to the special inquiry on which we are now engaged, "Love's Labour's Lost," which in its original form was probably the first of Shakespeare's comedies, is one of the most interesting of all his plays. Regarded as a dramatic composition it is full of faults. It has no plot. It can hardly indeed be called a play, being rather a series of conversations. We catch only a few notes here and there of the wit and humour and play of fancy of the later comedies. Often, indeed, we find instead of wit a somewhat ill-mannered raillery, instead of humour mere verbal quips, and though play of fancy is by no means wanting in this play (any more than in the still earlier "Titus Andronicus"), the poetical passages in which it finds expression are overloaded with imagery unsuited (as Shakespeare perceived later) for dramatic expression. Again and again we find the poet who was to develop in a few years into the greatest dramatist the world has known forgetting apparently that he is writing a play, and penning passages which might have appeared among his sonnets, to be admired (in their proper place) for their "sugred sweetness" and condensed fulness of meaning. Indeed, there are passages in "Love's Labour's Lost" which seem to me to have been as clearly borrowed from Shakespeare's collection of poems and sonnets as Longaville's sonnet "Did not the heavenly rhetoric of thine eye?" Berowne's musical little poem "If love make me forsworn, how shall I swear to love?" and Dumain's "On a day—alack the day! Love whose month is ever May." The resemblance between the style of the "sugred sonnets" and the language of some of the characters in "Love's Labour's Lost" is so great that to any but the most constant students of Shakespeare it would be difficult to say (unless memory settled the question) that a sonnet selected for the test was not in reality part of the play, or that a part of the play similarly selected was not a sonnet.

As an example consider the sonnet :—

> Study me how to please the eye indeed,
> By fixing it upon a fairer eye;
> Who, dazzling so, that eye shall be his heed,
> And give him light that it was blinded by.
> Study is like the heaven's glorious sun,
> That will not be deep-searched by saucy looks:
> Small have continual plodders ever won,
> Save base authority from others' books.
> These earthly godfathers of heaven's lights,
> That give a name to every fixèd star,
> Have no more profit of their shining nights
> Than those that walk, and wot not what they are.
> Too much to know is to know nought but fame;
> And every godfather can give a name.

Shakespeare, of course, would be careful, when embodying poems in the speeches of his *dramatis personæ*, to make such changes as would give them a more natural air. To a writer of his versatility and ease of diction this would be a simple matter. We must not, then, expect to find many complete poems in "Love's Labour's Lost," though, as the earliest of Shakespeare's comedies, it would be in that play probably more than in any other that Shakespeare would have allowed himself this use of his poems. Indeed, in its actual form, "Love's Labour's Lost" is probably so changed from the form in which it originally appeared that we may wonder rather to find any traces at all of the piecing-in of outside poems, than that only a few traces here and there should remain. It is evident, however, that Shakespeare, in modifying and enlarging the play, paid more attention to the re-writing of passages which seemed to him defective, and to the addition of matter which seemed wanted to make the play complete, than to any such minor point as the removal of the signs of 'prentice work in this his earliest comedy. Here and there we note cases where changes of the former kind were somewhat carelessly made, so that signs of "joining" remain. For instance, near the beginning of Berowne's rather lengthy "salve for perjury," we find the lines :—

> For when would you, my lord, or you, or you,
> Have found the ground of study's excellence
> Without the beauty of a woman's face?

While, a little later, the same thought is expressed more fully in the lines :—

> For when would you, my liege, or you, or you,
> In leaden contemplation have found out
> Such fiery numbers as the prompting eyes
> Of beauty's tutors have enriched you with?

Evidently Shakespeare had intended to replace the former passage by the latter, but left several lines unobliterated, or so imperfectly obliterated that his purpose was not recognised.*

* The printers of the folio would seem to have been perplexed by the corrections—not made in MS. (for the MS. of "Love's Labour's Lost" was probably destroyed in the *Globe* fire), but probably written as alterations and interlineations in such printed copy as Shakespeare had used for the theatre text. Thus we find the following :—

> Learning is but an adiunct to our selfe,
> And where we are, our Learning likewise is:
> Then when our selues we see in Ladies' eyes,
> With our selues.
> Doe we not likewise see our learning there?

Here the words "with our selues" belong manifestly to the original version, but had remained unobliterated. The printers seem to have found much difficulty in deciphering their copy, whatever it may have been. Thus in the folio the following passage occurs, which would be quite unintelligible were not the true version otherwise known :—

> "*Cura. Laus deo, bene intelligo.*
> *Peda. Bome boon for boon prescian*, a little scratcht, 'twil serue."

Evidently the reviser and compositor could make nothing here of the copy. *Bone* in the first line seemed clearly wrong; so *bene* was substituted, which would have made nonsense of what followed, even had it been correctly read. But in the next line they found (probably) corrections of the originally wrongly printed words for "*Bone* for *bene*," and these (the correct words) were written somewhat indistinctly above the wrongly printed words imperfectly scored out. In some such way they found five words which they evidently regarded as all belonging to some strange tongue, and so produced the "jewel, five words long,"—*Bome boon for boon prescian*. What Shakespeare wrote was :—

> *Cura.* [Sir Nathaniel] *Laus deo, bone intelligo.*
> *Peda.* [Holofernes] *Bone*, for *bene*. Priscian a little scratcht 'twill serve.

[Possibly Mr. Ignatius Donnelly may find some specially Baconian significance in "Bome boon for boon prescian." It being nonsense as they stand, the words would suit the Baconian theory perfectly.]

But while the signs of revision are thus evident in "Love's Labour's Lost," it is Shakespeare's self that Shakespeare thus revised: while the signs of inexperience are thus clear, we have in this play inexperience striving by self-study to grow into experience, not borrowing from the experience of others. "Titus Andronicus" shows us Shakespeare striving to write a tragedy after the style approved in his day, and erring more through the modesty which led him to accept the ideas of others than through the daring which led him, as yet a beginner, to adopt the strongly-marked style of older writers. In the earlier-written among the historic plays we see Shakespeare directly copying the manner of Marlowe, whose "mighty line" doubtless seemed to him at that stage of his career not easily to be matched, nor to be possibly surpassed. But, so far as is known, Shakespeare was working alone and without the guidance of others in his first comedy.

It is true Shakespeare introduces into this conversational comedy several of the characters of the Italian drama which he was at this very time studying under Florio. But although it has been said by Gervinus that the tone of the Italian school prevails in "Love's Labour's Lost" more than in any other of Shakespeare's plays, this is only true in a very limited sense. Holofernes may correspond in a sense with the pedant familiar in contemporary Italian drama, but he is as thoroughly English as Fielding's Adams; Sir Nathaniel, the Curate, may be paralleled by similar characters in Italian plays, but George Eliot's Amos Barton is not more obviously drawn from the life than Sir Nathaniel from a Warwickshire curate whom Shakespeare had known in his youthful days. As for Armado—the Braggart of the folio—Shakespeare, short as had been his stay in London when this play was written, had evidently made the acquaintance of Euphuisto such as London knew in those days, Piercie Shaftons such as then infested Elizabeth's court; and we need go no more to the Italian drama for the original of Armado than for the original of "Rare Ben's" Bobadil.

Still more obviously drawn from Shakespeare's own, and at the time still recent, experience are the characters Dull and Costard (in the folio simply Constable and Clown), Jaquenetta and Moth. Costard is own brother, by the way, to the Clown in "Titus Andronicus," a character which of itself would suffice to disprove the theory that Shakespeare was not (as Meres described him) the author of that crude and repulsive, yet (in many passages) powerful, tragedy. Compare their talk, and the resemblance will be as obvious (while the individuality of each is as distinct) as in the case of Launce and Launcelot. "Didst not thou come from heaven?" Titus asks the Clown. "From heaven! Alas, sir, I never came there!" says the poor fellow (presently to be hanged). "God forbid I should be so bold as to press to heaven in my young days." Costard is not readier to be unduly pressing heavenwards: "Did you hear the proclamation?" asks Navarre; "I do confess much of the hearing it, but little of the marking of it." "Sir," says the king, "I will pronounce your sentence: you shall fast a week with bran and water." "I had rather pray a month," says the Clown, whose tendencies are nevertheless by no means towards prayer, "I had rather pray a month with mutton and porridge."

But it is worthy of notice how little of that power which later he possessed in such marked degree—the power of truthful and consistent drawing—Shakespeare possessed, or at any rate showed, when delineating Costard. For in places Costard is as dull a rogue as Dull the Constable—a heavier Dogberry—while elsewhere he is as ready and apt in response as Touchstone. "They have lived long on the alms-basket of words," he says of the pedant and the curate; yet the man who could thus in ten pregnant words picture the folly of Holofernes and Nathaniel, and could answer Armado's threat that he should be heavily punished with neat sarcasm—"I am more bound to you than your fellows,* for they are but lightly rewarded"—blunders in the use of words as foolishly as Dogberry or Elbow.

The Italian touches in this play are, however, worth noticing, as showing that when it was written—probably about 1588—Shakespeare had already been for some time studying under Florio. He would not otherwise have pictured so thoroughly English a dominie as Holofernes speaking of Venice as Florio might have done (who, despite the strange fancy of Warburton, was no more presented in the character of Holofernes than in that of Berowne)—Venegia, Venegia, chi non te vede, ei non te pregia.†

Though the four gentlemen whose labours of love are lost have French names given them, they were probably drawn from Warwickshire folk well known to Shakespeare, Biron (Berowne of the folios) was our familiar British Brown, Longueville simple Langton, and Dumain plain Hand (all three are local names). The king, of course, would not be so readily identified by Shakespeare's contemporaries at Stratford; he may have been either a local king or a local magnate. It is noteworthy that, though he is a gentleman in act and manner, he is somewhat slow of apprehension. Of the four lovers he is the dullest and unreadiest. In one place he shows himself scarce able to count up to five. (The grace with which, after correcting the king's counting, Berowne passes from the mistake is worth noticing.)

As for the ladies, we have no evidence except that derived from their manner. The princess may pass for a French-woman or Italian—she is not drawn too definitely—but Rosaline, Maria, and Katharine are as thoroughly English as Jaquenetta or Audrey.

One is tempted to ask whether the black-eyed Rosaline may not tell us something of Shakespeare's weakness for dark women. We know from the later sonnets that after he had passed the days of early youth he was moved, despite his truer self, to love a dark lady who was not even beautiful, and whom by his own admission he could not love without being more seriously forsworn than Biron or his fellows. *On revient toujours à ses premières amours.* May we not imagine that in Biron's weakness, Biron being manifestly the character of all those in the play with whom Shakespeare was most in sympathy, he sketched in some degree his own? (Have we any knowledge, by the way, of Anne Hathaway's complexion?) ‡

> I forsooth in love! I that have been love's whip;
> What! I love! I sue! I seek a wife!

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* Probably a misprint for "followers."

† On the folio these words are strongly presented insomuch that one wonders what Shakespeare can possibly have written to be so mistaken. They run—"Vemchie, vencha, que non te vnde, que non se perreche." Possibly the MS. had the words—"Venechie, Venechie, que non te vede, ei non te perrechie," corresponding with a method of spelling which was even at that time passing out of vogue.

‡ It is worthy of notice with what zest Shakespeare pictures the love of Silvius for Phebe in "As You Like It." Altogether a minor character, and having but few words to utter, Silvius yet speaks his love more earnestly, if less volubly, than either Rosalind or Celia. Now it is noteworthy that Rosalind, in appraising Phebe, speaks much as Shakespeare would have presented such as Rosalind speaking of the dark lady of the sonnets:—

> I see no more in you, than in the ordinary
> Of nature's sale-work. Od's my little life!
> I think she means to tangle my eyes too.
> No faith proud mistress, hope not after it:
> 'Tis not your inky brows and black silk hair,
> Your bugle eyeballs nor your cheek of cream,
> That can entame my spirits to your worship.

Nay to be perjured, which is worst of all;
And, among three, to love the worst of all;
A whitely wanton with a velvet brow [*velvet* for *black*]
With two pitch balls stuck in her face for eyes.
And I to sigh for her! to watch for her!
To pray for her! Go to; it is a plague
That Cupid will impose for my neglect
Of his almighty dreadful little might.

Compare with this the self-drawn Shakespeare of the later sonnets, and it will at least be seen that, in attributing something of Biron's weakness for dark-browed, black-eyed, pale-faced women to the poet himself, we do not wrong him. Even the strange charm which Biron seems half to admit that he finds in the suggestion that Rosaline is amorous ("Ay, and by heaven," &c.) Shakespeare found in the dark lady of the sonnets:—

When my love swears that she is made of truth,
I do believe her though I know she lies.
. . . . .
O, love's best habit is in seeming trust, &c.

For the rest, the whole story of "Love's Labour's Lost" speaks of Shakespeare's loving recollection of the fair scenes and forest life of Stratford and Charlecote! From the first scene ("a Park with a Palace in it," but a palace into which none of the characters enter), through all the others (always "another part of the Park"), to the last songs of Spring and Winter, the whole play is full of English country ways and sylvan life.

FORCE AND ENERGY.

IN his otherwise capital work, "The Story of Creation"—the main portion of which appeared, by the way, in these pages—my friend, Mr. Clodd, continues his use of the word "force" to represent attraction, and "energy" to represent repulsion. But he gives reasons for the adoption of this incorrect usage which serve to show how it had its origin in the entire misapprehension by others of the actual use of the terms "force" and "energy" in books properly described as scientific:—

"In attempting," he says, "to give a clear idea of the mechanism of the universe, I have felt the difficulty expressed years ago by such authorities as Sir W. R. Grove and Professor Tyndall, arising from the lack of precision in standard books on physics in the use of the terms 'force' and 'energy.' When talking over this matter with my friend Grant Allen, I was delighted to find that he had published (although privately) a pamphlet on the subject, in which rigid and definite meanings are given to 'force' and 'energy' as the twofold and opposite forms of power manifest through matter; and in that sense, as affording the reader a clearer conception of cosmic dynamics, those terms are used throughout this book."

In the body of the book (p. 13) Mr. Clodd gives these "rigid and definite meanings" (their rigidity and definiteness are, indeed, unmistakable), which will rather raise the eyebrows of the scientific students of dynamics, especially when considered in connection with his purpose of clearing his readers' conceptions. They run as follows:—

(*a*) *Force* is that which produces or quickens motions binding together two or more particles of ponderable matter, and which retards or resists motions tending to separate such particles.

(*b*) *Energy* is that which produces or quickens motions separating and which resists or retards motions binding together two or more particles of matter, or of the ethereal medium.

By the oddest confusion between energy *as thus defined*—which, of course, is no other than our old friend, repulsive force—Mr. Clodd goes on to say of Mr. Grant Allen's "energy" what is only true of energy as correctly defined:—"A stone lying on a roof, a clock wound up but not going, have," he says, "potential energy" [that is, according to definition (*b*) they have potentially "that which produces or quickens motions separating, and which resists or retards motions binding together two or more particles of matter"], and this energy "becomes kinetic" (or is actually displayed in motion) when the stone falls or the clock goes. Yet I suppose it will be admitted of the stone (the clock may go by the out-pressing of a spring, a case of repulsion, or by the down-drawing of a weight, a case of attraction) that the potentiality possessed by it while at rest is a tendency to go towards the earth, a motion not separating but drawing together particles of ponderable matter. The distance it may have to travel when once freed to yield to the attractive influence (technically called the attractive force) measures the stone's power of getting into motion (technically called its "potential energy"). The motion it thus acquires, when considered not simply as motion, but in connection with the mass moved, is technically called *kinetic energy*. When the stone is brought to rest this kinetic energy remains in the movements of the stone's particles and of the particles of air around it—either in actual displacements, or in the vibratory motions whose effects are rendered sensible as heat. The former neither falls under definition *a* nor under definition *b*, because the particles moved draw towards some and from other particles. Nor can the vibrating particles be said to display attractive or repulsive (aggregating or separating) tendencies, their motions being essentially alternating. Mr. Clodd's—or rather, I suppose, Mr. Allen's—barrel of gunpowder has, on the other hand, unquestionably separating or expansive or repulsive potencies, which become kinetic when the powder is fired. Yet even here definition *b* does not apply to these tendencies in the rigid or definitive manner imagined by Mr. Allen and conceded by Mr. Clodd. The bottom of the barrel is pressed towards the ground by the action of what is technically called the explosive force of the powder; a fragment of the barrel, after flying a certain distance, strikes some other body: in each case the action displayed—so far as the wood, the ground, and the struck body are concerned—is of the kind producing motions drawing particles of ponderable matter together, not separating them. If this reasoning is objected to for the reason that the particles of gunpowder alone are to be understood as having potential energy according to definition *b*, the fault lies with the definition, which either says too much or too little—too much if we are to be thus limited, too little when the case of the stone is considered (for where are the particles potentially tending to separate in the stone's case?)

The fact is, Mr. Allen has obviously misunderstood altogether the trouble in regard to the inexact expressions employed occasionally by Sir R. Grove and Professor Tyndall (one may add Professor Huxley and Mr. Herbert Spencer), a mistake arising rather from the assurance that they could not be misunderstood, than from want of familiarity with the accepted limitations of the words "force" and "energy" as technically used from the time of Newton until now—in treatises on dynamics.

Sir W. R. Grove was taken to task, in somewhat pedantic sort, for speaking of electricity, heat, light, and the like, as physical "forces" in the title of his well-known work and elsewhere, instead of always (as in many parts of that treatise) speaking of them as "affections of matter." He in effect replied that the word "forces" as thus used could not well be misunderstood. His chief object had been to show that those "affections of matter" are "modes of motion," and every one would know that "modes of motion" cannot be described as "forces." Considering specifically (p. 18) the objection that "the term force" should be used "not as expressing the effect" (that is, motion or some affection of matter involving or depending on motion) "but as that which produces the effect," he says, "this is true,

and in this its ordinary sense I shall use it in these pages"—because "the term has thus a potential meaning, *to depart from which would render language unintelligible*"; though, as he quite correctly points out (the remark in no sense affecting his opinion as to the impropriety of any attempt to alter the technical use of the word "force"), "we must guard against supposing that we know essentially more of the phenomena by saying they are produced by something" (*force*), "which something is only a word derived from the constancy and similarity of the phenomena" (*motions* of various kinds) we seek to explain by it.

Assuredly Sir W. R. Grove would be far from welcoming the proposed limitation of the word "force" to one-half of its accepted significance, and the substitution of the word "energy" for the other half, with accompanying maltreatment of "attraction" and "repulsion" scarcely less painfully tending to (and suggestive of) bewilderment.

Professor Tyndall was very sharply, and as I think most unfairly, taken to task for using the word "force" (both in the singular and plural) as Sir W. R. Grove had done. Yet Professor Tait was undoubtedly right in saying that "the sense in which Newton uses the word 'force' is the sense in which we should continually use it" (if we are professedly using it technically) "if we desire to avoid intellectual confusion." And certainly Tyndall, who repeatedly distinguishes between attractive and repulsive "forces," and clearly recognises the correct meaning of "energy" as simply the capacity (potential or active) for doing work, would be sorely troubled at the thought that any looseness of expression on his part, where his real meaning could not be misunderstood, should have suggested the astounding idea of merging the distinctive word "attraction" into the general word "force," and the equally distinctive word "repulsion" into the word "energy," which (as constantly used in scientific treatises on dynamical physics) is perfectly distinct from all three.

Professor Huxley, whom I hold to be the most perfect living model of the man of science (because of all men known to me he is the readiest alike to maintain what he considers should be maintained and to concede what he considers should be conceded), used the word "forces" where, as he afterwards noted, the more general term "powers" would have been better. Is he likely, therefore, to rejoice to see the good old word which has now for two centuries done the same office in ten thousand scientific treatises invited to do half duty, and another word of entirely distinct character invited to abandon its own useful office and do the other half of that duty? Far from it. With characteristic manliness he goes out of his way (as weaker men would hold, but such a man as he can spare the extra travel when it seems necessary) to say that he would rather now write "powers" where he formerly wrote "forces." How Mr. Clodd has come to regard this frank admission by Professor Huxley that the word "force" should be limited to its proper use, into support of the entire misuse of that word (and others) I altogether fail to understand. What men like Sir Wm. Thomson (whom Sir R. Grove—rather significantly—calls Thompson), Professors Cayly, Adams, Sylvester, and their like, would say to the suggestion that the words "Force," "Attraction," "Repulsion," and "Energy" should be shuffled about as Mr. Allen has suggested I can guess, though I would rather not say. The mildest punishment they would inflict—though I fancy it would not be found very easy penance—would be that Mr. Allen should suggest some way of expressing the ideas now represented by "Energy," "potential energy," and "kinetic energy"; for assuredly his new definitions, whether regarded as rigid and definitive or as loose and ill-fitting, would leave these conceptions entirely unrepresented. The more severe would suggest that Mr. Allen should revise according to his novel ideas the whole body of scientific literature relating to matters dynamical. The nature of the task may be inferred from the first two steps which would have to be taken. How would Mr. Allen re-word the two first laws of Newton, remembering that, though originally written in Latin, these laws were repeatedly referred to by Newton as worded in English, thus?—

I. *Every body perseveres in its state of rest or of uniform motion in a right line, unless it is compelled to change that state by* FORCES *impressed on it.*

II. *The alteration of motion is even proportional to the motive* FORCE *impressed, and is made in the direction of the right line in which that* FORCE *is impressed.*

May I be permitted to present a parable for the benefit of—whomsoever it may concern?

For centuries the words "trade" and "wealth" ("potential" and "material") had been used in all treatises on Political Economy in the sense in which they are still understood. But it chanced that several writers—among them an able theologian, a learned lawyer, and an experienced archæologist—in writing on their several subjects used the word "trade" where the more general word "commerce" would have been better, and seemed (but only seemed) to confound the word "manufactures" with the expression "material wealth." A pedant or two corrected this, though the writers criticised pointed out that no one could misunderstand their meaning. Hearing of this, an entomologist of great acumen as a naturalist and singularly graceful as a scientific writer, but whose studies gave him no actual occasion to write about trade or commerce or manufactures, or political economy generally—who, in fact, rather disliked these subjects—advocated an entire change in business language. Let us hereafter, said he, call all forms of importation *trade* and all forms of exportation *wealth*. . . . It was urged that the four good words——Trade, Import, Export, and Wealth—would all be put to entirely new uses, if the change were adopted; that the literature of political economy would have to be rewritten; and that new expressions would now have to be adopted to express what had heretofore been understood by Wealth, Material Wealth, and so forth. One might as well, said one, speaking as in a parable, propose that Dress should signify the Clothing of Men, and Costume the Clothing of Women. Whether the innovator (who had in the meantime taken to writing fairy tales) was convinced, this deponent sayeth not. But the new usage was not adopted—and it never will be.

Mr. Grant Allen would do well to test the idea expressed in his privately published pamphlet by preparing a small treatise on some dynamical subject involving all four of those conceptions—"Force," "Energy," "Attraction," and "Repulsion"—respecting which he has been moved to anxiety. Unless I mistake, he would find his rigid and definite meanings perplexingly elastic and confusing. A pamphlet on the motion of a shell moved by the repulsive action of exploding powder, and travelling in a resisting medium, first against the attractive action of gravity, and afterwards in response to that action, would afford excellent exercise, not only for the writer, but for the reader (if the new nomenclature were consistently adopted), especially if the shell were suffered to explode just before reaching the earth, and the movements of its parts (assumed equal and of given number) were carefully dealt with. Science is entitled to ask that those who suggest new uses for words which have been for centuries used (*by Her*, at any rate) in determinate ways, should in some such way show the convenience and value of the new nomenclature, and manifest

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some sort of right (based on special knowledge) to propose changes in the language of science.

My protest has been urged in the interests of the class of writers for whom I myself have striven to cater, and for whom Mr. Grant Allen and Mr. Clodd have catered most successfully. The former in particular (I know my friend Mr. Clodd will not be angry with me for putting the matter thus) is, to my mind, simply unequalled by all our English writers on popular science for grace and elegance of style and versatility of treatment. (It grieves one to the heart to think that powers such as his should for want of the due appreciation of science in our day be increasingly wasted on those who appreciate only sensational fiction.) But it is because I feel deeply interested in the spread of sound information about scientific matters among the general public, that I protest earnestly against changes which, by separating the language of scientific literature from the language of exact science, would tend if accepted to make "confusion worse confounded"—by replacing mere difficulty of apprehension (such as all exact scientific studies involve) by sheer bewilderment. Carelessness in the use of scientific terms is doubtless unfortunate; but studied inaccuracy would be a disastrous remedy.

THE STAR STORY OF THE FLOOD.

(*Continued from page* 147.)

AMONG the constellations which have thus been deprived of their ancient character, none equalled in interest the great ship Argo. It is difficult for any one who studies a modern map of this constellation to imagine that it was ever like a ship. Nay, the resemblance cannot now be well traced even in the heavens, for a reason presently to be considered. Yet the configuration of an immense ship, with lofty, well-rounded poop, with masts and sails, and deck and keel, is singularly striking, when the original extent of the constellation (reduced by modern astronomers) and its original position (changed by that slow precessional reeling of the earth which has for its period 29,000 years) are taken into account.

As to the original extent of the great ship Argo, astronomers of two distinct ages have been at work cutting off parts of the ship piecemeal. Originally, as the heavens still tell us, the ship had a noble prow as well as that lofty stern of which I have spoken. But the astronomers of some 2,500 years ago, in altering the figure of a man standing at the prow into a Centaur, removed to make the horse part of the Centaur the stars which had originally formed the prow of the great ship. (I have no authority for this last statement except the prow-like form which the stars of the Centaur's body picture; but for the former there is the evidence of ancient astronomers that the constellation which later represented the centaur Cheiron—identified by some with Noah—originally represented a man, not a man-horse.) In the time of Eudoxus (about four centuries before Christ), whose ideas about the constellations the poet Aratus presented two centuries later, Argo represented the stern half of a ship, drawn backwards into harbour. I find that, as might be expected, this corresponds with the aspect and position which the constellation then had. When at its full height in the southern skies of Greece, or Egypt, or Persia, Argo's keel was aslant, the stern end being considerably higher than the fore part, so that as the diurnal motion carried Argo along stern first, the motion was like that of a ship drawn stern first up a slant shore. At present this idea is no longer suggested, the slant being now so great that nothing but hauling a ship stern first up a cliff would correspond with the celestial position and motion of Argo; and ships are not so commonly hauled up cliffs in that manner, that even the most imaginative mind would find such an idea absolutely forced upon it.

In the time of Eudoxus also, the poop of the ship had been to some degree interfered with as well as the prow, for some of the stars of the stern are wanted to complete the figure of the Greater Dog. But probably in Eudoxus's time there was not the least difficulty in regarding these stars as doing double duty. The fore-half of the ship had been bodily removed, but the outline of the stern was not probably impaired at all to make room for Canis Major. In our time, of course, this has happened. The outline remains still somewhat like that of an ancient poop, but it is not nearly such a fine poop as the old ship had. Not only the stars marking the dog's hind quarters have been removed, but as the outline of the poop is thus contracted, another group of stars formerly belonging to Argo can no longer be included within the outline. Out of the stars of this group Hevelius formed the constellation Noah's Dove, apparently judging that it was a rather ingenious device to represent the dove as flying from what was originally the rudder (or stern oar) of the ark. But the moderns have done worse even than this, clipping off one part of the keel of the ark to make, or help in making, a Chameleon, and another part to help in making a Flying Fish. This was Lacaille's work. On the other side—that is, in the ship's upper works—he was equally absurd, setting in the ship's masts—or perhaps on the roof of the ark—an Air Pump, of all unlikely objects to occupy such a position. Another modern constellation, the Southern Cross, though really part of the original ship, was taken from it long before modern times, to form the hind feet of the Centaur. The modern astronomer, therefore, has not constructed the Cross out of the ark, in which there might have been found a world of suggestive meaning, but has abstracted it from what was already an abstraction, the hinder portion of the centaur Cheiron.

So soon as we picture the stars of this region as they were in the time of the Great Pyramid, and (practically) for three or four centuries before and afterwards, we find such a ship as the modern stellar skies no longer present—a constellation so striking that even the least observant must have recognised its ship-like form.

In the first place, Argo falls in the most remarkable part of the whole heavens. Covering the richest region of the stellar skies, it is bordered by a broad tract which is absolutely the darkest part of the star-sphere. Between the thinly strewn region which marks the sails and mast of the ship as at present pictured, and the long winding stream of stars marking the sea-serpent Hydra, over a tract extending from the head and shoulders of the Centaur to the constellation of the Little Dog—a range of nearly ninety degrees!—there is not a single star of the first, second, or third magnitude, while there are only three stars of the fourth, and very few of the fifth magnitude. The rich tract formerly occupied by the Great Ark, and now occupied by the Centaur, Cross, Southern Fly, Argo, the Dove, and the Greater Dog, though less in extent than this poverty-stricken region, contains six first-magnitude stars, twelve of the second magnitude, thirty-two of the third—that is, no fewer than fifty stars of the first three magnitudes alone, besides an amazing wealth of stars of the fourth, fifth, and sixth magnitudes, and widely spreading masses of the Milky Way. The region thus richly crowded with stars of all orders, and distinguished from the surrounding heavens not only by the poverty of the region just described but also by another but narrower poverty-stricken region on the other

side (the keel line of the ship), is about eighty degrees long and forty degrees broad.

Now, in the time of the Pyramid builders, this region was so situated that its length was parallel to the horizon when the region was at its highest above the southern horizon. Thus the great ship had its proper position as floating on a sort of heavenly sea, the horizon of which was the celestial equator, along which was the great Sea-serpent, floating lazily onwards—for the motion of the star sphere carried Hydra forwards, his head reared above the sea level, towards the west. It is to be noticed also that the elevation of the ship above the natural horizon of Babylon, Persia, Greece, or Egypt, was such as to give the ship the most natural appearance possible, for the keel would be actually on the horizon of the three first-named regions, and raised very little above the horizon in the latitude of Athens. From a picture which I have drawn showing the southern skies of Babylon at midnight in winter—about the time corresponding to the middle of December—I find that Argo must then have presented such an appearance that it would require no liveliness of imagination whatever to picture a grand celestial ship there—nay, rather that only the dullest imagination could fail to have this idea suggested to it most strongly. Certainly the scene then presented by the star-strewn skies above the southern horizon was more striking than any which the skies present now, in any latitude and at any hour.

Recognising this remarkably suggestive aspect of the heavens in the days of the pyramid builders, and remembering the importance attached to the ship Argo alike by ancient observers of the stars, and as belonging to ancient myths, I was led to inquire further respecting the constellations brought successively above the southern horizon as the year passed on.

In the first place, I observe that preceding the arrival of the great Ship as the ruling southern constellation at night, there came a long array of those watery constellations—Capricornus, Aquarius, Pisces, and Eridanus—which the ancient astronomers regarded as undoubtedly associated with flood and deluge on the earth. Till far later times, the belief prevailed that when all the planets are conjoined in Capricorn the world would be destroyed by flood; but the superstition had its origin in that remote time to which we are now extending our survey. An old idea of mine was thus recalled to me, that in the constellations of the watery kind (as the old astrological astronomers considered them), the ship Argo, and certain others, the story of the flood as related in Genesis is presented—men either finding in the heavens the record of what had happened on the earth, or picturing a series of events in the heavens which they later transformed into a terrestrial legend. But now I had the means of dealing with this idea much more satisfactorily than when I touched upon it formerly in a merely suggestive way. For, in the first place, I now had the exact aspect of the stellar heavens for every month and every hour of the night at the time to which the story must be referred, and in the latitudes whence the Egyptian and Babylonian astronomers observed the heavens; and in the second place, the reading of the Ninevitish cuneiform inscriptions on the one hand and the study of Egyptian Biblical lore on the other, had thrown enough light on the deluge narrative to show how it was in a general sense to be interpreted.

In what follows, I employ the story of Noah in Genesis chiefly as giving the best record we probably have of what at the time of the Captivity was the accepted account of the deluge as to times and seasons. Probably the cuneiform inscriptions, as read by Messrs. George Smith, Sayce, and others, present rather a popular form of the legend than the full record which the priests of Babylon possessed, and which they were ready to communicate to the more learned and devout among the Hebrew priests. At any rate, it is clear that precise details as to dates were given to the scribes and priests of Judah, and by them transferred to their sacred books, the narrative being only so far modified as to emphasise the story of the origin of the Hebrew race as the chosen people of God.

The story, alike in Egypt, in Babylon, and in Jerusalem, relates to the tenth of the first generations dealt with by legend or history. Noah is the tenth antediluvian patriarch; Hor is the tenth Egyptian god; Xisuthrus is the tenth Chaldean king. The idea associated with the deity, king, or patriarch—according to the race among whom the story appears—is that of rest. The singular prophecy by Lamech respecting Noah, thus finds a partial interpretation: "This same shall comfort us for our work and for the toil of our hands because of the ground which the Lord hath cursed." But the explanation becomes clearer when we recognise in Noah a solar hero, and in the account of the deluge a very ancient solar myth—as Goldziher, Steinthal, and other Hebrew scholars (rejecting Professor Max Müller's idea that the Hebrews had no mythology) have learned to recognise. Xisuthrus is the sun at setting; the journey of Xisuthrus is the journey of the sun at night below the horizon: but also, as in all solar myths, the sun is dealt with here as god of the year, not solely or even chiefly as god of the day. Thus, the hero of the deluge legend is the god of winter, which, like night, brings rest from agricultural labours.

As in all solar myths, however, we find in the legend of the deluge the record of a full year, and—as has long been considered remarkable by Bible commentators—precisely one year of 365 days. The life of Enoch, it is to be noticed, is given as 365 years, and it is noteworthy that a certain confusion may be recognised between Enoch and Noah, as between their Egyptian and Babylonian analogues. The seventh Egyptian god, like the tenth, is named Hor; and, again, Xisuthrus, the Babylonian Noah, is translated after the close of his achievements as a solar hero, as Enoch is translated after his solar life of 365 days. It is true that the year of 365 days was not in general use either in Egypt or Chaldæa; but the length of the year was known to the astronomers of the Pyramid time with much greater accuracy than even the period of 365 days would indicate—probably it was known within a few minutes of the true value. Just here it may be noticed that the Jewish Midrâsh compares the course of the sun to a ship coming from Akrâmania (wherever that may be) with 365 ropes, and to a ship coming from Alexandria which has 354 ropes (354 being the number of days in a lunar year). There is a Phrygian legend that the king or patriarch Annakos, *i.e.* Enoch, being more than 300 years old, predicted the flood, and prayed with many tears and lamentations for the people. The dates directly associated with the flood in the Babylonian account, presented (we may assume) in Genesis, belong to Mesopotamia, where great floods attain their greatest height in spring, at the season indicated as the time when Noah's flood was at its highest. Dr. Bell tells of a flood in Mesopotamia so high at this season, that as far as the eye could reach nothing could be seen from the highest tower of the Baghdad mosques but a great waste of waters, studded here and there with a few date groves, which appeared like little islands: "Thousands of square miles," he says, "were at that time under water." These floods commonly begin towards the end of October, and the waters continue to increase, though the rains are not continuous until spring. But, of course, the Babylonian record of the flood, though it may have been

suggested by a natural Mesopotamian flood of this kind, relates to a flood much more widespread and far more terrible in its effects. We have here intermixed, after the customary mythical fashion, the magnified and intensified events of an ordinary flood, the diurnal progress of the sun-god (and especially his journey in a ship beneath the horizon) and the annual journey of the sun as god of the year, during a time when all the heavenly powers combined their influence in the watery constellations.

So much premised, let us trace the annual progress of the constellations which, at the time of the Pyramid builders and their Babylonian fellow-workers in astronomy were below the horizon of the star sphere—marked by the equator—and let us see how far the constellations as pictured corresponded with the events recorded in the narrative. It is to be observed that the mere agreement of a few cases would count for little. The agreement of several, in precise order, as well as in the characteristics of the constellations, would be more significant. But if we shall find the whole circuit of the star-sphere corresponding with the Babylonian narrative as presented in Genesis, and even the dates and periods there mentioned adequately represented, then, as it seems to me (regarding the matter as merely one of probabilities), the evidence will be decisive.

I picture to myself observers stationed in the grand meridional gallery of the Pyramid of Cheops, or in some similar observing passage in the Temple of the Planets at Babylon, watching, night after night, throughout the year, the constellations occupying the southern skies below the celestial equator—which at the Egyptian observatory ranged sixty degrees above the southern horizon and some two degrees less above the Babylonian. Only it must be remembered that the constellations they would see on the midnight sky would be those whose influences would affect their solar god, not at the season of observation, but just half a year before or after, when the sun would be travelling through or past those constellations.

Beginning, then, with the seventeenth day of the second month, which all agree would correspond with the end of October, we find the part of the stellar heavens in conjunction with the sun to be the beginning of the watery constellation Capricornus, regarded by ancient astronomers as of all the signs the one which most directly threatened flood. Thence for the space of nearly five months' journey the sun was in conjunction with none but watery constellations. After the Seagoat came the Water-Bearer Aquarius, whose jar and the streams flowing from it are pictured very strikingly in the heavens, however imperfectly shown in the modern much-reduced constellation. Then follow Pisces, the Sea-Monster Cetus, and the streams of Eridanus. (In my opinion the water streams from the vessel borne aloft by Aquarius were regarded as extending over Capricornus on the one side, and on the other over the Fishes, the Sea Monster, and the great river Eridanus, the whole of this large region of the heavens being most curiously traversed by a network of interlacing star-streams.) For one hundred and fifty days the sun was in conjunction with these watery signs, viz, from the end of October till about the time of the spring equinox, when also the terrestrial skies in Babylon seemed to respond to these watery influences. Now it is noteworthy that, although this watery region extended over one hundred and fifty days' sun-journey, the special flood signs extended only over forty days of the solar path. From the beginning of Capricornus to the place where the main stream from the water-can of Aquarius crosses the sun's path—or from near Alpha of the Seagoat to near Phi of the Water-Carrier, there are just forty days of solar travel. This corresponds precisely with the record of the flood. The rain was on the earth forty days and forty nights—and after the end of an hundred and fifty days (including the forty) the waters decreased.

At this stage we find, in the stellar story of the flood, the Ark floating on the wide expanse of pictured sea. Above, along the equator, lies (or rather lay, at the time to which we are looking back) the full length of the great Sea-Serpent; below that water horizon extended a broad tract of starless sky; and below that again the starry splendour of the great ship herself.

Counting now to the tenth month on the first day of the month, "when the tops of the mountains began to be seen, we reach the place where Cor Hydræ, the Sea-serpent's Heart, stood on the equator, the horizon of the celestial sea. Then followed forty days more, at the end of which Noah opened the window of the ark which he had made, and sent forth a raven." Now just at the corresponding point we find the ancient constellation of the Raven, standing on the Sea-serpent, or just above the equator, as if finding no place on the land. If we were to trust the modern pictures of the Raven, this might seem of little moment. For with characteristic perversity, the modern map-makers have turned this constellation upside down, and the case becomes one of those referred to by Mr. Lang, when the liveliest imagination can trace no resemblance between a star group and the object pictured. But the old globes and charts set this right. The raven is in reality a very characteristic bird. His high-shouldered attitude when at rest, and a certain angularity of wing then shown, are features which strike the observer at once. Now the constellation Corvus, representing the chief of the *Corvidæ*, the Raven, is also striking. It is a small group, but well marked, and surrounded by comparatively vacant skies. So soon as we picture a Raven standing upright on the Sea-serpent's back, not as in modern pictures in the attitude of a fowl picking up seed, we recognise the outline of a raven in the star-group, as distinctly as we see a Dolphin in the group so called, a crown in Corona Borealis, and other objects in similar small but well-defined groups. Thus the Raven of the flood story is well pictured in the heavens, and occupies precisely the position corresponding to the dates in the Babylonian record, as preserved for us in Genesis.

Then follow three weeks, or twenty-one days, corresponding to the intervals at which the dove was sent forth. I might dwell on this reference to the week, the first of the kind in the Bible pages, as of itself sufficing to indicate the astronomical, and especially Babylonian origin of the story. But I pass on to consider the rest of the record. I cannot find three doves in the stellar picture, nor could they be reasonably looked for. It is curious, however, that there are three characteristic undulations of the tail of Hydra, *i.e.* stars which require to be connected by an undulating line to keep up the serpentine idea—ranging over precisely three weeks of the diurnal motion of the star-sphere. The crests of the undulations are marked (1) by the stars Gamma and Psi; (2) by the star Pi; and (3) by a set of five small stars bearing no Greek letter, but numbered by Flamsteed 54 to 59.

And now we have reached the prow end of the ark, and find standing there the human part of the Centaur, a fine manlike figure. This constellation has always been regarded as bearing sacrifice to the Altar, Ara. He was upright in the southern skies at the time we are dealing with, a circumstance which helps the imagination in picturing the figure of a man. His head was marked by a group of small stars; Theta and Iota marked his shoulders, Alpha and Beta his feet. A long straight row of stars, extending on the east to Kappa, marked the spear or rod, on which he bore an animal, later called a wolf, towards the altar. Few of the human constellations are so characteristically defined in the

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heavens as the man part of the Centaur, with his spear and offering for sacrifice. Standing upright, some twenty-five degrees in height, and so that as seen from the ascending passage of the Great Pyramid, he just stood, when due south, within the portion of the heavens commanded by the grand gallery, this stellar figure must have presented strongly the idea of a man offering sacrifice—at least to a race accustomed to see their priests daily engaged in sacrificial observances.

But the Altar, where is that? The constellation of the Altar is there still, both in the heavens and in our maps. But since the fifteenth century the altar has always been represented upside down, insomuch that the Centaur is represented as carefully applying a wolf to the altar's inverted base, a proceeding which would have seemed unreasonable even to one of the drunken Lapithæ. However, there is luckily no sort of doubt that this arrangement of the altar is only a "modern improvement." The Farnese globe shows the Altar upright—that is, as upright as it could be since the precession of the equinoxes tipped it over. Manilius distinctly suggests its uprightness when he speaks of the Altar as

Ara, ferens thuris, stellis imitantibus, ignem.

For an inverted Altar could not have been seen as bearing anything. Turning to the heavens of 3400 or 3500 B.C., we find the Altar truly upright, and we see the smoke of the incense, imitated by stars in the rich streams of the Milky Way, which extend from the altar like ascending clouds and wreaths of smoke, over the Scorpion on one side and over Sagittarius on the other. The brightest galactic stream here is that over Sagittarius, where, indeed, the Milky Way has at once its most resplendent and its most variegated aspect. The incense smoke from the altar on the side towards Scorpio fades off into the dark background of the sky, but on the side towards Sagittarius there is a bright and continuous stream, gathering in places into rich clustering masses.

The sacrifice of Noah is accepted by Deity, the smoke bearing the essence of the fire-consumed flesh was of a sweet savour in His nostrils, to use the quaint expression of later Bible writers. "And God said," says the ancient record we are following, "This is the token of the covenant which I make between Me and you and every living creature that is with you for perpetual generations: I do set my bow in the cloud, and it shall be for a token of a covenant between Me and the earth." It may be regarded as a mere coincidence, though strange as coming after the coincidences already noted, but certain it is that in the cloud rising from the Altar, the bow of Sagittarius was recognised by the ancient worshippers of the sun and moon and stars. There is the figure of a man or god, standing on the other side of the Altar, facing the man who offers sacrifice (coming upright, like him, on the meridian of the time we are considering), and this figure holds out in the cloud from the Altar a celestial bow (twenty degrees in length), which might well have been regarded by the astronomical priests of those days as typifying the rainbow, and its promise as recorded in the ancient story of the flood.

And here in the stellar skies, as in the detailed record, the year has completed its full circle. Immediately beyond the figure of the being holding the bow, we come upon the constellation of the Sea-goat, where the story of the flood begins again in the heavens. On the seventeenth day of the second month the flood began, according to the record in Genesis, on the seven and twentieth day of the second month was the earth dry—a year of twelve lunar months had passed, 354 days (the 354 ropes of the old sun-ship story), and in addition eleven days, completing the solar year of 365 days. If we have not here a solar myth, pictured in the stellar heavens, and, as it were, reflected in the terrestrial skies, and the annual floods of Mesopotamia, then it would seem as though all belief in solar myths and nature myths must be rejected; for certainly in not one single case have the believers in such myths found such evidence as we have found here. I do not say that no such evidence might be collected for those other myths. I believe that by the help of astronomical research the evidence of those myths can be greatly strengthened. But certainly in the present case, the first I think which has ever been dealt with in this manner, the evidence seems very striking. If it is all to be explained away as due to mere chance coincidence, then must the coincidence be regarded as so remarkable, that even as such it is well worth studying.

GROWTH OF THE ALPS.*

THE Alps have been studied longer and more thoroughly than any others of the great mountain ranges of the earth. Their structure is, in fact, typical. Although it is now considered doubtful whether any of the exposed portions of the Alps can be regarded as of Archæan age, there is absolutely decisive evidence of the growth of the Alps from Silurian strata through all the higher primary formations, and thence upwards and onwards through the secondary and tertiary periods to the great glacial age which was, as it were, the threshold of the period through which Europe is now passing. The record we have to read is necessarily imperfect. The forces by which stratified rocks are subjected to plications and fractures have acted with amazing energy on the Alpine strata. The characteristic features of the lower strata have gradually disappeared among those of the crystalline masses forced through them. "The whole geological aspect of these mountains," says Professor A. Geikie, "is suggestive of former intense commotion." The record has also been in large part destroyed by denudation. "Twisted and crumpled," Professor Geikie proceeds, "the solid sheets of limestone may be seen as it were to writhe from the base to the summit of a mountain; yet they present everywhere their truncated ends to the air, and from these ends it is easy to see that a vast amount of material has been worn away. Apart altogether from what may have been the shape of the ground immediately after the upheaval of the chain, there is evidence on every side of gigantic denudation. The sub-aërial forces that have been at work upon the Alpine surface ever since it first appeared have dug out valleys, sometimes acting in original depressions, sometimes eroding hollows down the slopes. Moreover, they have planed down the flexures, excavated lake basins, scarped the mountain sides into cliff and *cirque*, notched and furrowed the ridges, splintered the crests into chasm and *aiguille*, until no part of the original surface now remains in sight."

But though the Alps thus "remain a monument of stupendous earth-throes, followed by prolonged and gigantic denudation," they yet attest with sufficient clearness the processes by which the material of their structure was originally formed. The volumes in which the record was written are all more or less incomplete, but none are absolutely missing—unless it be the first, if we can speak of the first volume of a series which in point of fact can scarcely be said to have had a beginning.

* Chiefly from an article on "The Everlasting Hills," in the *Fortnightly Review*.

The first leaves of the first extant volume are so blurred that their meaning is doubtful. Formerly it was held that a continuous belt of absolutely Archæan rocks can be recognised westwards of the central portion of the Alpine range. But now it is doubted whether the Alpine formations once regarded as Archæan are really so. Yet even holding them, as the only possible alternative compels us, to be but metamorphosed equivalents of what originally were lower Palæozoic strata, their record is scarcely less impressive.

A little higher—that is, a little later in the volume—we find unmistakable Silurian, Devonian, Carboniferous, and Permian rocks, unmistakable because of the fossil forms present in them. The oldest fossils actually recognised are Upper Silurian, and speak of a time which, even at the most moderate computation, must be set twenty millions of years back. No geologist, no palæontologist, no biologist of repute would admit any approach to so recent a date as that; but astronomical and physical considerations *appear* to suggest that we should to that degree shorten the immense periods of time which the geologist regards as demonstrated by the terrestrial record. Taking only that degree of remoteness, and noting that these Upper Silurian strata rest on unfossiliferous crystalline rocks which are certainly much older, our record goes far enough back to overwhelm us by the unimaginable time-intervals of which it bears testimony.

It is curious to read, in these older books of the earth bible, not only of organic remains speaking of the former existence of seas covering the innermost core of the Alpine range, but of abundant corals of Devonian age. For corals are the products of such slow processes of formation that they are eloquent in the evidence they give respecting time. In the carboniferous strata, which belong to a later portion of this earliest Alpine record, we find evidence of an abundant flora, no less than sixty forms of vegetation characteristic of that era having been recognised. How many thousands of years the sea stood there and coral reefs were builded up, how long the interval may have been during which for a while these seas retreated and forests grew on the low-lying lands above their level, we cannot tell. But we know that those periods must have been incomparably longer than those by which we measure the history of man.

Red sandstone tracts attest the progress of the Permian era and renewed presence of the sea. Higher (measuring stratigraphically), and therefore later, we find limestone strata crowded with evidence of marine life. Whole layers of these Triassic rocks are formed of the crinoid stems of fossil echinoderms, sea-urchins, brachiopods (including the familiar* but most ancient mollusc, the common terebratula), are found in large numbers. Corals are abundant, and fossil cephalopods, including multitudes of nautili, tell us not only of the forms of life present in that ancient Triassic sea, but also that the more ancient seas could never have departed wholly from the Alpine region, seeing that many of these Triassic fossils are survivals of forms of life belonging to the Palæozoic period. In passing it may be remarked that certain strata, somewhat metamorphosed but manifestly belonging to the Trias, were penetrated in piercing the Mont Cenis tunnel, and showed a thickness of more than thirteen thousand feet. On the Northern Apennines these strata include the celebrated statuary marbles of Carrara.

* Familiar in appearance, and so commonly found by the seashore, attached to submarine bodies, that probably every one who has ever walked beside the sea has handled dozens of their shells; yet science not only recognises their vast antiquity, but has given them very hard names, calling them "palæobranchiate acephalous bivalve brachiopod molluscs."

The great thickness of the Triassic limestone in the Eastern Alps appears to show that they must have formed in open seas, free from inroads of sandy or muddy sediment. It is believed by some that in the conglomeratic dolomites of the Eastern Alps we can recognise signs of the breakers of that ancient sea, grinding down the coral reefs and carrying the thin dolomites into the lagoons within.

Higher and later yet, in the Jurassic series, we find similar evidence. Reddish well-bedded limestones, so crowded with *Terebratula diphya* as to be called the Diphya limestone, lighter limestones full of cephalopods, immense coral reefs—all these attest the long-lasting influence of this second stage of the great Mesozoic or secondary period in the formation of the Alpine range.

Then came the last stage of the secondary period, the Cretaceous. It is strange to picture a time when, where now the Alps rear their snow-covered peaks, there were wide seas, beneath whose surface such layers were forming as those out of which the chalk cliffs of Albion have been carved. Nay, we have evidence that in that selfsame region were once seas bounded by just such cliffs, for while we find layers of Cretaceous formation hundreds of feet thick in the Alps, we find also intercalations of coal-bearing fresh-water beds, showing how the seas from time to time retreated for periods long enough to permit of the aggregation of these coal-bearing strata. From some of the lake-beds of that age in the Alps large numbers of reptilian remains have been obtained, including dinosaurs, turtles, a crocodile, a lizard, and a pterodactyle; in all, no fewer than fourteen genera and eighteen species. But, of course, the greater portion of the matter belonging to the Cretaceous era in the Alps is of marine formation.

And now the record brings us to recent times—not more, perhaps, than a million of years ago, or some such trifling period as that.

Of the earlier tertiary era, the Eocene, the dawn of modern life-forms has left clear evidence in the Alpine rock-masses. A remarkable feature of the Eocene strata in the Alpine region is the presence of immense erratic boulders of far greater antiquity, apparently carried off by great glaciers from Archæan masses such as still exist in Southern Bohemia, and borne across sea on ice-floes to the Alpine shores. But if a wide sea existed during the Eocene age in the Alpine region, there were alternations during which land appeared, for in the Northern Tyrol a seam of coal thirty-two feet thick occurs as an Eocene deposit.

The Oligocene age, still nearer to our own time, is represented with wonderful fulness in the Swiss Alps. Massive mountains, such as the Rigi and Rossberg, are almost wholly formed from Oligocene strata, several thousand feet in thickness, out of which they have been carved. They attest very clearly the presence of the sea, but they have also preserved in singular perfection large numbers of the plants originally clothing the neighbouring Alpine shores, and even the insects which, in those far-off ages, flitted through the Alpine woodlands.

In the Miocene or latest portion of the tertiary age we have clearer and fuller evidence yet. "In the Oeningen beds," says Archibald Geikie, "so gently have the leaves, flowers, and fruits fallen, and so well have they been preserved, that we may actually trace the alternation of the seasons by the succession of the different conditions of the plants. Selecting 482 of those plants which admit of comparison, Heer remarks that 131 might be referred to a temperate, 266 to a sub-tropical, and 85 to a tropical zone." Between 800 and 900 species of insects have been obtained from Oeningen. Wood-beetles were especially numerous and large. "Nor did the larger animals escape preservation," to quote Geikie's rather odd expression, in the silt of

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the Oeningen Lake. Tapirs, mastodons, rhinoceros, musk deer, apes, opossums, three-toed horses, were among the inhabitants of that Alpine region. Ancient ruminants long since extinct were numerous. The huge dinotherium floated on the lake, or held on to the banks by the huge tusks of his under-jaw. Frogs, toads, lizards, snakes, squirrels, hares, beavers, were abundant, as well as numbers of small carnivores to feed upon them; for if Nature "never makes mouths but she finds food," she assuredly attends to the converse arrangement with at least equal anxiety.

The last stage of all—that is, the last of all the grander stages of geologic time—belongs to the glacial era. As far as Lyons along the Rhone valley, extending through the transverse valleys of the Jura as far as Ornans (near Besançon), along the Rhine valley above Basle, over the Black Forest, and down the valley of the Danube beyond Sigmaringen eastwards (joining the glaciers from the Bavarian Alps) as far as Munich, far out into the plains of Lombardy on the south, the moraines of the mighty Alpine glaciers of the Pleistocene age can be recognised. In some places the moraine rests on marine Pliocene beds; and there are reasons for believing that in several directions the glaciers reached the sea, as those of Greenland do now. The Great Ice Age, whose stupendous records thus remain, was not continuous. In interglacial periods the ice retreated, and allowed an abundant vegetation to flourish, even in the heart of Switzerland. The strata belonging to these milder periods overlie the moraines of more ancient glaciers, interstratified with sands and river gravels, and are in turn surmounted by erratic boulders, the product of a later glacial era.

With these Pleistocene pages, bringing the history down to within perhaps a hundred thousand years of our own time, our study of the Alpine record may well cease. It is but one set of books, one set out of many of like nature, some promising to be more striking still in their teaching when they have been fully studied. Other mountain ranges speak of still more stupendous processes of formation, and even of vaster time-intervals. Others, less massive, speak nevertheless of a more venerable age, since they have now gone far upon their road to decay. Others, although they have become mere wrecks, are yet more interesting as being the earth's most venerable antiques.

The hills are indeed "everlasting," viewed as men must view them. Even as the stellar regions are for us practically infinite, so do the records of the earth run over periods which are for us practically eternal. Yet in another and a grander sense the everlasting hills are evanescent.

> They flow
> From form to form, and nothing stands;
> Like mists they melt, the solid lands—
> Like clouds they shape themselves and go.

GEOLOGICAL ARCHITECTURE.—A curious effect of the wear and tear to which the earth's crust is ever being subjected is exhibited in the singularly capped pinnacles existing on the South River in the Wahsatch Mountains. There are hundreds of these slender pillars, ranging in height from forty to 400 feet, most of them crowned by large caps of stone. They are not works of human art, as might almost be imagined, but are the memorial monuments of the once rounded hills, from which they have been cut by the action of air and water. These pinnacles alone remain of some square miles of solid rock, which has been washed away to a depth of 400 feet. The greater hardness of the surface has caused it to resist corrosion more than the underlying rock, thus leaving the huge stone caps perched high in air on the points of the thin columns. At one point, while this carving process has been going on, a thin wall of rock was penetrated, leaving a lofty natural bridge or arch, which adds to the picturesqueness of a remarkable landscape.

SIMPLE MECHANICAL TRICKS DEPENDING ON GRAVITY.

AMONG mechanical tricks few are more effective than those depending on gravity, and few are more readily managed, the constructions required for such tricks being usually very simple. They are also highly instructive and suggestive. It is indeed easy for the young mechanician, as soon as he has caught the principle on which they depend, to devise new tricks, not less striking than those more familiarly known.

In the first place it should be noted that in most of the mechanical tricks depending on gravity the observer is to some degree deluded; for the selfsame principle of gravity may be illustrated in such a way that the experiment seems natural and ordinary, or in another which makes it appear surprising and even startling.

Take, for instance, the experiment of suspending a weight on a coin standing on edge upon the point of a needle. This is illustrated sufficiently in fig. 1. Two knives K and K′ are thrust into a cork C, into the under side of which, as shown in the figure, a coin, *s s′* (a shilling is the most convenient) is thrust. When this combination is placed in the manner

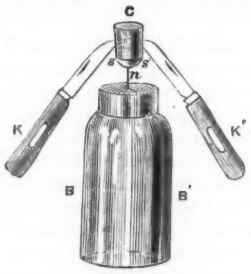

FIG. 1.

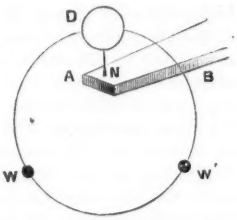

FIG. 2.

shown, so that the under edge of the coin rests on the point of a needle *n*, fixed vertically in any way (as by thrusting it through a cork in the mouth of bottle B B′), the apparently unstable poising is found to be in reality perfectly stable. The knives can be struck so as either to set the balanced combination oscillating or to set it rotating upon the needle's point, without any risk of the balance being destroyed.

Though this experiment or trick has a surprising appearance, the principle on which it depends may be illustrated in practically the same way without causing any surprise whatever; and though this is not the thing specially aimed at in mechanical tricks, yet it is instructive to see how a trick which seems surprising when performed in a particular way resolves itself into a quite ordinary experiment when differently arranged.

This may be done for the trick we have considered by means of such an arrangement as is shown in fig. 2. Here a needle or other sharp-pointed support is fixed vertically into a bar A B, and on the point of this a wire bearing two weights W and W′, and attached in the manner shown to a disc D (which may be a shilling if preferred), is set simply hanging upon the needle's point. In this experiment it is so obvious that the case is merely one of suspension, the equilibrium being akin to the swinging of the pendulum, that the experiment has scarcely even any interest for the observer: he sees at once that the wired weights *ought* to hang freely and safely on the needle's point. But it is obvious that if we remove the part of the wire under the weights, and replace the parts D W and D W by straight wires we have reproduced—without alter-

ing the character of the experiment—the selfsame conditions which produce a more surprising result in the case illustrated in fig. 1.

There is a familiar toy which represents a dragoon mounted on a galloping horse. This horseman may be set prancing on the edge of a table in the liveliest fashion without any risk of an upset, and when so moving seems to present a perplexing puzzle, even though the source of his stability is displayed without any concealment. The horse and his rider are really kept in stable equilibrium by means of a weight at the end of a curved wire which passes from the stomach of the horse downward and backward, so that when the horse is set upon his hind legs at the edge of any support the weight is under the horse's hind feet. In this position the weight is practically as the bob of a pendulum; the only difference is that the weight is connected by a curved wire and the wooden figure of a horse with the part resting upon the place of suspension, whereas the bob of a pendulum is usually at the end of a straight wire. When we set the horse galloping, we set the weight underneath swinging, precisely as we might set a pendulum swinging; and there is no more chance of the horse upsetting than there is of a well-swung pendulum jumping off from its place of support.

A number of experiments akin to the galloping dragoon may be devised for exhibition without any special apparatus. Take for instance a heavy handled carving fork, a cork, a strong needle, a flat-headed nail, and a piece of wood, dealing with them as shown in fig. 3. The nail is driven into the piece of wood W, the fork F is driven into the cork C, through which the needle $n\,n'$ is thrust. The fork,

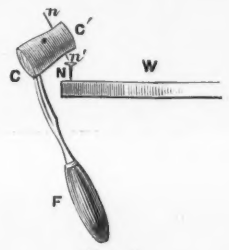

FIG. 3.

cork, and needle may then be safely set swinging on the needle's point, which rests on the top of the nail, the piece of wood being held horizontally as shown. The movement, as the fork swings, is really that of a weight hanging from a point of suspension, and is seen to be obviously stable as soon as its true nature is considered. Yet it has a strange effect to see the apparently unstable combination swaying on a nail top, and on no better point of suspension than the end of a needle.

In the last experiment the nail and piece of wood are not necessary. A fork taken from the dinner-table, and a cork probably found "handy by" (for even in these days of prohibition persons who can trust themselves and their company not to get intoxicated, occasionally have such an infernal machine as a bottle of champagne, port, sherry, or burgundy opened at their table), will, with a strong pin or other representative of the needle, serve the purpose of the experimenter sufficiently. The combination can be set swinging with the pin point resting on the flat handle of a spoon, or even, if the experimenter is handy, on an end of one of the prongs of a silver fork.

Still simpler ways of showing the same illustration of the point may be suggested. Thus take a lead pencil, rather bluntly pointed, and a parlour fire-poker, and tie the middle of the pencil (say two inches from either end) to a part of the poker two inches from the working end. Then bringing together the large end of the pencil and the end of the poker, set the point of the pencil on the edge of the table in the manner illustrated in fig. 4. Then P, where the poker and pencil meet, can be depressed so as to set poker and pencil swinging on the point p' of the pencil, with perfect freedom from all chance of an upset. In this form the trick

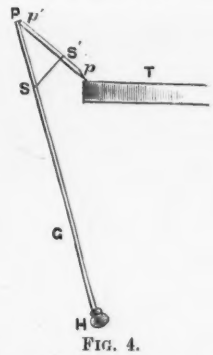

FIG. 4.

is particularly effective because the string $s\,s'$, which replaces the rigid attachment of the other cases, seems insufficient to make the connection between the suspended body and the point of suspension p' effective; and the pencil and poker are known to be free from any attachment at P p. Yet when the poker is set swinging it is easy to see that the pressure at P p' and the tension along the string $s\,s'$ make the connection between the weight suspended and the point of suspension sufficient as against all the forces which are in operation. The weight of the pencil and poker together acts vertically downward through the centre of gravity G, and since this is below the point P the equilibrium is stable. G oscillates under P, precisely as the bob of a pendulum swung from P would oscillate.

In these experiments we have simply a suspended body, so shaped that when it is poised the centre of gravity is hanging below the point of suspension. Thus every movement given to the balanced body raises the centre of gravity above its lowest portion, just as any movement given to the bob of a pendulum raises it in greater or less degree. The swinging motion illustrates the tendency of the centre of gravity to seek the lowest position which it can attain. This is the secret of all experiments in equilibrium. In cases of stable equilibrium the centre of gravity tends to rise under the action of external forces, and the force of gravity brings it back, the body oscillating like a pendulum around the position of rest; in cases of unstable equilibrium it will be found that the action of external forces tends to depress the centre of gravity, to which movement gravity lends its aid, in such sort that the body moves farther and farther away from the position in which it had been unstably poised. The trick in the experiments above described consists in so arranging matters that a position of stable equilibrium is made to look like a position of instability.

(*To be continued.*)

THE well-known firm of W. Watson & Sons, of 313 High Holborn, occupied a very important position at the late Crystal Palace Photographic Exhibition, and their exhibits attracted considerable attention from the trade and amateurs alike. They were awarded two medals, one of them for cameras and fittings (with special commendation for the introduction of interchangeable parts) and the other for tripods and studio stands.

MESSRS. MARION & CO. were also very successful, and obtained a medal for appliances for artificial illumination, another for mounts, a third for albums and cases, and a fourth medal for general appliances and plant.

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THE DRAGON AND THE GREAT SHIP.

THE two pictures representing the ancient constellations of the Dragon (including the stars now belonging to Ursa Minor) and the great ship Argo (including the stars now belonging to Canis Major, in part, Piscis Volans, &c.) will be found to illustrate my remarks about the "Stars of Other Times" (in KNOWLEDGE for April, &c.).

THE PLANET MARS.

A MAP of this planet is preparing, which will appear next month. The work of comparison between the many hundreds of drawings of the planet available for study has taken a longer time than anticipated. But the map will be ready now very soon.

In the meantime I would call the attention of observers to the excellent opportunity they now have for studying the feature which Schiaparelli attributes to "double canals."

I have accepted as the best available explanation of the observed appearances, that the rivers on Mars observed under different conditions account for all observed appearances.

First. If, as is probably the case in the winter of either hemisphere of Mars, there is much cloud over a Martian continent, the rivers on that continent would not be discernible at all.

Secondly. If, as is probably the case, for some time before each equinox the clouds clear away from a continent on Mars but still hang over the Martian rivers on that continent, they would cause the rivers to appear like silver threads of exceeding fineness if Mars could be seen as he is. But in a telescope even of great aperture the points of light along the river would be seen as diffraction discs, each surrounded by a ring of definite diameter; and the combination of all these diffraction discs would form what would look like a relatively bright streak bordered by two dark streaks (corresponding to the dark spaces around each diffraction disc). [The relatively bright streaks corresponding to the bright rings would not be recognised as bright streaks, being merged in the light background of the Martian continent.]

Thirdly. When the clouds were cleared away from a Martian continent, and also from the rivers upon it, which must often be the case during Martian summer, the rivers would appear like dark streaks—of course much broader than the rivers really are, because the image of a point along one of these rivers is not point-like, even with the most perfect telescope.

All that has hitherto been observed by Schiaparelli, Perrotin, Thollon, and others corresponds with the theory here advanced. (It was first advanced by me in the *Newcastle Weekly Chronicle* very soon after Schiaparelli announced his startling discovery of the Martian double canals.)

What is now wanted is a series of observations of Mars near the autumn of the northern hemisphere (on which most of the "double canals" have been seen). Mars will pass the equinox (autumnal for his northern hemisphere) on or about August 6, and will be well placed for this particular research during June and July.

It will hardly be necessary to remind observers that they should carefully try the effect of varying the aperture of the telescope they may use. If the "double canals" are phenomena of diffraction they would be best seen with a certain aperture, such as would give to the dark ring round the diffraction disc of a star a diameter equal to from a tenth to a twentieth of the diameter of Mars. If the space between the "double canals" be found to correspond with the span thus resulting for a given aperture, the diffraction interpretation of these phenomena would be confirmed; if the space varied with varying aperture, and in accordance with the known relations between the aperture of the object-glass and the size of the diffraction disc, that interpretation would be established.

THE NEW ASTRONOMY.*

PROFESSOR LANGLEY (we hope we are right about the title, but our author's title-page mentions nothing which in England would be regarded as implying professorship) gives as the *raison d'être* for his book the desire to reach those members of the community on whose support the endowment of research chiefly depends. He has written, he says, not for the professional reader (whatever that may mean—in England professions are very various), "but with the hope of reaching a part of that educated public on whose support he" (presumably the "professional reader") "is so often dependent for the means of extending the boundaries of knowledge." This vague purpose may be a sufficient reason for the shortcomings of the book before us. Professor Langley evidently has a very poor idea of "that part of the educated public on whose support, &c." But whether this be so or not, the mere idea of the endowment of research has long since been made to "stink in the nostrils" of the British public. Professor Langley himself has passed from a fairly salaried position with splendid opportunities (of which he has well availed himself) for independent research to a position much better salaried, but without those opportunities. We propose, then, to examine his book with strict reference to its worth, and without considering (what in a different connection we would consider with enthusiasm) his undoubted services as Director of the Alleghany Observatory to the cause of original research.

In the first place, we note that "the educated public on whose support" he depends would seem to be regarded by him as better able to judge appearances than so mere a trifle as intrinsic value. Or it may, perchance, be his publishers, Messrs. Ticknor & Co., of Boston, who suppose that the public will be content with the weight of paper and binding supplied them, without considering the amount of information conveyed, or of new thoughts suggested. Be this as it may, Professor Langley's book is amazingly heavy for the number of pages it contains, and better suited for the desk than the hand—save of the athlete to whom the raising of 56 lbs. at arm's length is a pleasing exercise. The cover positively creaks as it is opened, so stoutly and strongly (and, alas! so heavily) is it built. Sterne objected to the application of rule and square by the critic to the books he may have to consider; but in the case of the book before us, such points as weight and structure force themselves upon the reader's—or rather the holder's—attention. We find that "Professor" Langley's "New Astronomy" weighs rather more than Sir John Herschel's "Outlines of Astronomy" and Mr. Clodd's "Story of Creation" together. This is a serious matter. Without rushing at once to the conclusion that we can in such cases adopt the idea conveyed in the famous epitaph—

> Lie heavy on him, Earth: for he
> Laid many a heavy load on thee,

or insisting with the Greek philosopher of old that a big book is a big evil, we may at least ask whether the importance of the contents, in this case, corresponds with the weight of the book. It may be temper resulting from wrist-weariness, or it may not, but we are moved to say that the number of pages in Professor Langley's book is surprisingly small compared with the weight; the quantity of matter surprisingly small compared with the number of pages; the amount of astronomical information amazingly small compared with the quantity of matter; the proportion

* "The New Astronomy." By Professor S. P. Langley. (Boston: Ticknor & Co.)

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of original matter singularly small compared with the number of statements; and, lastly, the ratio of the true to the new even more startlingly insignificant. The most striking statements in the work are that the sun is much hotter than any except Ericsson, Secchi, and Zöllner have imagined, and the moon under her midday sun much colder, for neither of which statements is a particle of evidence vouchsafed (probably because "that part of the educated public on whose support, &c.," is not supposed to be capable of understanding anything so highflown as evidence). We venture to maintain the superior probability of the accepted doctrine on both points, though as Professor Langley professedly eschews mathematics and expresses even contempt for them, we cannot explain our reasons for preferring the law of Dulong and Petit to that of Newton (where the excess of temperature of the radiating body is considerable).

By the general public in America, the style of writing adopted by Professor Langley is, we understand, considered pleasing and attractive. We take a passage at random to illustrate American tastes (if we are rightly informed) in such matters. Mr. Langley is talking about the November falling stars:—

"If the reader will admit so rough a simile, we may compare a flight of these bodies to a thin swarm of swift-flying birds—thin, but yet immensely long" (strange birds!), "so as to be, in spite of the rapid motion, several years in passing a given point" (still, we must repeat, these are strange birds!), "and whose line of flight is cut across on the 13th of November, when the earth passes through it" (that is, through the line of flight of a flight of these bodies). "We are only there" (where?) "on that day, and can only see it" (what?) "then, but the swarm is years in all getting by" (*sic*), "and so we may pass into successive portions of it on the anniversary of the same day for years to come. The stars appear to shoot from Leo only because that constellation is in the line of their flight when we look up to it" (but whether "it" is the constellation, or the line, or the flight, Professor Langley does not say), "just as an interminable train of parallel flying birds would appear to come from some definite point on the horizon." (Can we confidently conclude that an interminable train of parallel birds, whatever parallel birds may be, would *necessarily* appear to do anything in particular, unless something more definite about their interminable trainery is indicated for our guidance?)

One of the strangest things in this treatise on "The New Astronomy" is, that whereas the subject would seem too large even for a work as capacious as Herschel's "Outlines of Astronomy," in *this* work, which contains less than a fourth as much letterpress as that noble treatise (though it is priced at half as much again), the author seems constantly concerned lest each single thing he has to tell "that educated part of the public on whose support, &c.," should not occupy an adequate amount of space (not to mention his anxiety to introduce matter wholly irrelevant). Here, for instance, is the way in which he spins out the stale old story of Galileo's anagram about Saturn (we can afford no larger type):—

"When Galileo first turned his glass on Saturn, he saw, as he thought, that it consisted of three spheres close together, the middle one being the largest. He was not quite sure of the fact, and was in a dilemma between his desire to wait longer for further observation, and his fear that some other observer might announce the discovery if he hesitated. To combine these incompatibilities" (*sic*), "to announce it so as to secure the priority, and yet not announce it till he was ready, might seem to present as great a difficulty as the discovery itself" (we are not joking: every word of this is in the text!); "but Galileo solved this, as we may remember, by writing it in the sentence, 'Altissimum planetam, tergeminum observavi' ('I have observed the highest planet to be triple'), and throwing it, in the printer's phrase, 'into pi,' or jumbling the letters which made the sentence into the monstrous word—

SMAJSMRMJLMEBOETALEVMJPVNENVGTTAVJRAS,

and publishing *this*, which contained his discovery, but under lock and key.* He had reason to congratulate himself on his prudence. &c., &c."

* Mr. Proctor in "Saturn and His System" had a whole volume as large as "The New Astronomy") to give to Saturn, yet we find that all the story told by Mr. Langley from "He was not quite sure" to "under lock and key" (134 words, counting the anagram as 4) is conveyed in 53 words as follows:—"He announced the supposed discovery to the world of science in the form of an anagram produced by transposing the letters of the sentence: 'Altissimum,' &c., 'I have observed that the most distant planet is triform,' adopting this fanciful plan to prevent other astronomers from claiming the honour of the discovery."

Even this, however, is far from being the worst example of attenuative expansion in this ingeniously constructed work. As to space-filling, we have full-page pictures of a cracked glass globe, a shrivelled hand, a falling man, a lightning flash, a scene from the Bessemer works, Professor Langley's camp at Mount Whitney, Vesuvius during eruption, and other non-astronomical matters. Thirty-one full-page pictures in the book are printed as plates (most of them being quite unworthy of any such distinction), yet counted in the paging. But for this ingenious device (which we have never seen in any book of the sort printed out of America), Professor Langley's book, which seems to contain 250 pages, would show but 188.

Professor Langley is an excellent observer in certain departments of physics (despite his weakness—and worse—in matters mathematical), and has done work which has been highly and justly valued; but he has not treated his public with respect, or the publishers of the "Century Magazine" (for whom the essays gathered into this volume were written) with fairness. There are five or six good (but by no means new) pictures in his "New Astronomy," and about two pages of matter at once sound and originally suggestive; all the rest might have been presented in about fifty pages, including cuts.

The "New Astronomy" is strongly though not handsomely bound, and well printed on singularly stout and glossy paper—but, on the whole, we feel sorry for "that educated part of the public" (presumably the American public is meant) "on whose support, &c. &c.," if the opinion which Professor Langley and his Boston publishers appear to have formed of their capacity is just. We believe, however, that the general public in America, as well as in England, want the cream of science, and will not be content with a sky-blue dilution; and we are sure that no devices of printing and binding will make Brother Jonathan regard a little treatise as a large one, though it be "fixed" as a large volume.

SHAKESPEARE AND DONNELLY.

APOLLO AND THE MUD-DAUBER.

MR. DONNELLY has enabled even the dullest to see what sort of value is to be attached to his critical comments on Shakespeare's work and personality. For at length he has published some of the products of his cryptogamic cyphering — products with which neither Shakespeare nor Bacon, but Ignatius Donnelly alone, has had anything to do.

With regard to the legitimate criticism in Mr. Donnelly's book, we note only that it contains no new idea from beginning to end. The argument based on parallel passages is too puerile for comment, though we can believe that any one knowing little of Elizabethan literature may honestly believe that the resemblances are striking. The now notorious cypher, like all such inventions, is one by which anything whatever could be proved. With four root numbers any one of which may be taken, as many modifiers, the power of counting words on any column of any page, from the top or from the bottom, with or without bracketed words, with

hyphened words counted separately or as one, and other variations which Mr. Donnelly allows himself, he can, of course, find everything he wants to find. We must take what he finds as what he tells us that he wanted to find, as what he himself has conceived. Even as our "Benvolio" finds in what Shakespeare wrote evidence of what Shakespeare thought, though dramatically presented, so (only with greater certainty) what Mr. Donnelly has evolved out of his more or less moral consciousness about Bacon and Shakespeare tells us what manner of man Ignatius Donnelly is, and with what sort of a mind he has crawled over the memories of England's greatest and best.

We will not follow him. Let any one read but one paragraph of Mr. Donnelly's cypher reading—say that in which he presents Bacon as painfully forcing into a noble play a series of foul insults respecting the man whom (even according to Mr. Donnelly's nonsense) Bacon thought worthy to be regarded as the author of the greatest dramatic works ever known, and he will have read more than enough. Since the time when Mrs. Stowe wrote that atrocious attack on the memory of Byron, nothing fouler has been conceived than Donnelly's picturing of Shakespeare as a decrepit wretch (when little past thirty), eaten up with disease, drunken, besotted, and imbecile.

We decline to consider further this loathsome work, "rank without ripeness, rotten without sun," the product of a coarse and abject mind. There is a passage in Shakespeare which rises to our thoughts as needing but the change of a word or two to express more aptly than anything known to us the feeling with which we have read this hateful production—a disgrace to America and to literature. When Iachimo has pictured Posthumus Leonatus as foully as Ignatius Donnelly has pictured Shakespeare, and has then as plainly shown the cloven hoof, Imogen says to him what every clean-minded Englishman should say to Donnelly:—

> Away!—I do condemn mine ears, that have
> So long attended thee.—If thou wert honourable
> Thou would'st have told this tale for virtue, not
> For such an end thou seek'st,—as base as strange.
> Thou wrong'st a gentleman, who is as far
> From thy report as thou from honour.
> . . . If [England deems] it fit
> A saucy stranger in [our land] to mart
> As in a Roman stew, and to expound
> His beastly mind to us—she has [a son]
> She little cares for, and her chief glory
> She not respects at all.

NOTES ON AMERICANISMS.

HARM, adjectively for "hurtful:" a Southern usage, claimed by Bartlett for Georgia.

HATCHET. To "bury the hatchet" is to make peace; derived from the Indian custom of solemnly burying a tomahawk when peace is made.

HAULED MEALER. The *Saturday Review* says (and the *S. R.* always knows) that this expression used for persons carted to and from the fields for their meals is an Americanism, and one worth knowing. Striped pullers for members of a London rowing club wearing striped jerseys would be as reasonably included among Cockneyisms.

HAZE, To. The most characteristically American use of this word is that which associates it with the ill-treatment of freshmen by the higher classes. Collegians in America seem to be about as foolish in such matters as lads at our public schools. Certainly our universities now offer nothing which corresponds to "hazing;" and though 'Varsity men are fond enough, and too fond, of noise and fun, the particular combination of brutality and cowardice known as "hazing" in America is unknown in our colleges, and regarded as disgraceful (though not quite unknown) in the army and navy.

HEFT, for weight, though used in parts of England, is oftener heard in the States, and may fairly be considered an Americanism. The same may be said of "heft" used as a verb, in the sense of "taking" the weight of anything. Mr. Bartlett includes "heave," used for "throw," among Americanisms, but there is hardly a part of England where this usage is not familiar.

HEFTY. Heavy.

HELP. This word for "servant" is of English origin, but it has undergone a singular change. Of old a "help" was one who helped the servants, the term implying inferiority. Now the word "servant" is objected to as degrading, and "help" is used in its place. To the word "servant," regarded as derived from the Latin, there are objections akin to those existing against the word "subject," seeing that the so-called servant is no more a slave than the so-called subject is in real subjection. The word "help," however, is but an unsatisfactory substitute.

HERB. In England it is permissible to aspirate the "h" in this word, though probably the word is oftener pronounced 'erb. In America it is never aspirated.

HICKORY. Owing to the toughness and hardness of hickory (a species of *Carya*), the word is often used as equivalent to tough, hard, or resolute. General Andrew Jackson was called "Old Hickory" because of his firm and resolute character. Yet the word sometimes means flexible—hickory being capable of bending without breaking. A "hickory bend" means a bend which only some substance like hickory can take without breaking. It is used in surgery of bones which, under a severe blow, have bent yet not broken. Those who would wish to prove that the Indians came from the East may find an argument for the theory in the rather curious circumstance that the Greek name for the species to which the hickory belongs—ἡ καρύα—is almost identical in sound with the Indian word from which "hickory" was derived.

HIGH FALUTIN. High-flown, derived by Hotten from the Dutch *verlooten*, but by Bartlett and others from "high flighting," a word which needs accounting for as much as the other.

HIRED MAN, or woman, or girl. One who is hired for work: see "Servant."

HITCH. To hitch together, or hitch horses, is to get along well together.

HOE ONE'S ROW, To. To do one's share of a job.

HOG-WALLOWS. Places in the western prairies which look as though hogs had wallowed in them and torn them up. But hogs in reality have had nothing to do with them. Cracks form in the prairies during the droughts of summer (usually where the prairie is level), forming hexagonal patches eight or ten feet in diameter. During the heavy rains which follow the earth gets washed into the cracks, and after several years peculiarities of contour arise which present the appearance attributed—unjustly—to the wallowing of hogs.

HOME. The "old home," used for the old country, shows that even to this day some Americans remember that America was colonised by Englishmen, was rendered independent through the courage and energy of Englishmen, and is in point of fact of English production. If all Englishmen and all Americans remembered this, we should not so often hear either Englishmen or Americans speaking ill of each other.

HOMINY. Coarsely ground Indian corn, boiled.

HOMMUCK or HUMMOCK. See "Hammock."

HONORABLE. This term is applied to members of the

Senate and of Congress, also to members of the State Legislatures. It is retained afterwards for life. Bartlett says the rule is "Once an honorable always an honorable;" but, according to the papers, the rule is not once an honourable always honourable, any more than in Great Britain once a noble implies always noble, though an American politician has a much better chance of being credited with an honourable character when he has retired from the running. Men who, like Garfield, chance to die in office even get qualities attributed to them which were not only questioned during their lives, but which they certainly never possessed. Anything more preposterous than the way in which Americans abuse their "honorables" while they hold office, and afterwards pretend to compare them with Europeans not only honourable but noble in their lives, can hardly be conceived. Notoriety and fame seem regarded as synonymous.

HOODLUM. A Californian word for a rough blackguard, akin to a "cornerman" in Liverpool. Rough, rowdy, larrikin, hoodlum—it would be difficult to distinguish between them otherwise than as the "rough" is English, the rowdy American east of the Rockies, the hoodlum American west of the Rockies, and the larrikin Australian.

HOOK, TO. To steal. Those acquainted with the literature of English *argot* will be amused to find Mr. Bartlett classing this word as an Americanism. In Hogarth's well-known cockpit, the method of stealing, from which the use of the word "hooking" for "stealing" had its origin, is illustrated in practice.

HOOSIER. A nickname for native of Indiana. The term was originally used in a disparaging sense to indicate rough frontier ways.

HOPPING MAD, for exceedingly angry, is a common expression among the more vulgar in America. It is not stated by any competent authority that Americans in any part of the States really indicate anger by hopping.

HORSE-FIDDLE. Any instrument constructed coarsely and roughly to be played after the manner of a fiddle, and producing execrable and atrocious noises. In different States different ideas of the best way of making a horse-fiddle prevail. But any arrangement from which, by a process akin to "bowing," a gruesome noise to be heard a long distance can be effectively produced deserves the title. In England this particular form of "horse-play" is no longer in vogue. Some Americans conclude, therefore, that we are behind the times. But we had our brutal noises in past ages (*vide* Hogarth's industrious apprentice — the Charivari), and have got through that form of nonsense—in which, strange to say, even the roughest English folk have long since ceased to find any fun.

HOSE. The modest way of mentioning stockings among the immodest in parts of America, and especially in some of the western States. Some persons are so depraved in their imaginations that to speak of the human legs, or of stockings, or breeches, or other appurtenances of the understanding, suggests (so far as one can judge by their talk) all sorts of gross ideas. It is among these, unfortunately far more numerous than Americans of the more decent sort imagine, that the false delicacy ridiculed by travellers in America had its origin. It is a pity, because visitors in America often have no idea what nastily minded folk they may meet in society otherwise perfectly respectable. Offence has been unwittingly given, again and again, where no offence had been intended or even imagined. And, oddly enough, the persons thus astoundingly "nasty" consider themselves exceedingly "nice." They retain their sense of offence for years after the innocent event which caused offence has passed away, and talk of the offender, who in the meantime remains perfectly innocent of his offence, as if he were a blackguardly fellow who did not know how to address properly minded people.

HOSS for "horse," and especially as a slang title for a person of great courage, resolution, and strength, may be regarded as an Americanism, though it is sometimes heard in parts of England. There is a ridiculous story about an American actor who represented Richard III., in Shakespeare's play of that name, which curiously illustrates the use of this term. "He came down to the footlights," said the enthusiastic narrator, describing the death scene—"he came down to the footlights—yes, sir!—and he wrapped the star-spangled banner around him, and died like the son of a hoss." Higher praise could no American give.

HOUND. Although the word "hound" is in use in America as in England for a term of reproach, as also is "dog," you may use the word without offence in American society: but to use the female name for the species, even in talking about dogs and sport, is regarded by persons of the kind described under "hose" as an offence of the first magnitude.

HOUNDS. A name very appropriately given to a gang of cowardly ruffians, akin to "white caps," "vigilants," and other such villains, who banded themselves together under the pretence of "regulating" immigration into California in the old days of 1849. It may be hoped that most of them were in the long run shot or hanged, as they deserved.

HOW? Pronounced *haow*? This interjection used for *what*? and intended as an abridgment of "how's that?" (for "what did you say?"), is very often heard in New England, and not unfrequently (owing to intermixture) in other States. It has a vulgar sound, more marked, I imagine, in the ears of cultured Americans, who have learned to associate it with inferior culture, than with us English folk, who simply regard it as an amusing Americanism.

HOW D'YE? Pronounced "howdy"—Southern for "how do you do?"

HOW'S THAT FOR HIGH? Bartlett absurdly puts as the equivalent for this quaint expression—"What is your opinion as to the height of it?" He might as well have said that it signified "How many inches, ascertained trigonometrically, does it span in a vertical direction?" The expression is always used in a quaint and half-ironical manner. For instance, a man will show a picture in flaming colours, and with glaringly grotesque figures, and ask "How's that for high?" Or he will ask the question after reading some absurdly grandiloquent passage in a speech or description.

HUB. Boston is commonly known in America as "The Hub"—short for Hub of the Universe. (How's *that* for high?)

HULL, for "whole," a pronunciation often heard in the States.

HUMAN, A = a human being.

HUNKEY = capital, first-rate. A "hunkey boy" would correspond to our English "no end of a brick," and the Irish "broth of a boy."

HUNKY DORI, or HUNKYDORUM; something superlatively good.

HURRY UP, To. Americans say "to hurry up" where we say "to hurry." I remember the first time I heard the expression it considerably startled me. In those days it was customary for the railway conductors to go round collecting tickets in the sleeping-cars at all sorts of unearthly hours in the night. My ticket was asked for about 4 A.M., and I was feeling for it through my pockets, when the conductor called out impatiently, "Hurry up!" "Why, I thought we did not get into New York till seven?" I said, stopping in my search for the ticket to attend to the more serious business of getting up. "Oh, shucks!" was his polite reply; "hurry up with that ticket."

HUSH UP. This expression is equivalent to our English "Shut up," or to the American "Give us a rest."*

HYPER, To. To hurry, or, as Americans say, to "hurry up."

HYPO, for "hypochondria," is probably English, but I have never heard the word except in America.

HYST, for "hoist," is sometimes used in America to describe a "fall," but (a distinction Bartlett fails to notice) only a fall which is so violent as to be followed by some sort of rebound. It is the rebound, not the fall itself, which is the "hyst."

ORIGIN OF LIFE.

A NAVAJO TRADITION.

THE Navajo Indians of Arizona have a tradition to the effect that while the earth was young and destitute of animal life the Great Spirit created twelve people—six men and six women—together with many species of animals, and confined them in a cavern of the San Francisco mountain, where they lived as a great happy family for many years. But in course of time a restlessness possessed the prisoners. Though they had known nothing of freedom, all felt the oppression of their narrow limits, and vaguely yearned for a greater fulfilment of the dream or reality of living. But what could they do? All speculated on the situation to no purpose. Daily they jostled each other, little and big, clumsy and nimble, bipeds and quadrupeds, feathered and furred, winged and wingless, timid and bold. Every successive period of time was but a repetition of the past.

None of the many puzzled brains could offer means of breaking the monotony, till a happy thought struck one of the most insignificant of the living mass. For want of other occupation a locust bored a hole in the wall and thereby opened the way for the enthusiasm and progress of the host of its comrades throughout the length and breadth of their underground world. The Great Spirit had so decreed it. They were there only for a time of incubation. At the destined hour, as the eaglet bursts the shell that imprisons it, so the locust's tiny burrow should lead to the escape of all into the open world, where each could follow his inclinations unhampered.

The labouring locust had but a solitary witness. A badger watched with growing amusement the diminutive tunnel-making. His eyes sparkled with interest as the locust laboured energetically. He lay resting with his head between his fore paws in a most lazy attitude, but his face expressed animation and eagerness not much longer to be retained. As the tail of the locust disappeared the time for exertion had come. To follow the locust's movements further necessitated like energy. The locust's hole was too small for the badger's access, so he started a tunnel-making of his own. By the time he reached the locust he was in no mood to give up the chase, so he passed on, scratching his way through the solid earth until he broke through the outer crust of the mountain, and in the joy and excitement of the moment he sprang into the ample space before him. The mountain side was steep, and he "landed" in the shallow edge of the lake in Montezuma valley. As he fell his fore feet struck deep into the mire, and his progeny even unto to-day have inherited black fore paws because of this incident of the world's first peopling.

The Navajoes within the cavern, noting the departure of the badger, began a "prospect." Finding the hole large enough for exit, they crept out, one after the other, and a train of all sizes and species of animals followed in their wake, as from Noah's ark.

As soon as all the prisoners were free, fire and smoke began to issue from the hole that had delivered them. This frightened them far away into the valley, and there they prepared to make themselves comfortable and live as their new advantages permitted. Food was plentiful in vegetable forms, but some varieties needed heat to make them good. At least the Navajoes thought so, but they had no means of kindling a fire. This difficulty was soon overcome by sending a bat, a wolf, and a squirrel after the needed element, fire. Going to a hole in the mountain, the wolf tied some pitchy splinters to his tail, then turned and held it over the little volcano till it began to smoke and ignite. The bat then fanned it into flames with its wings, and the squirrel carried it away to the Navajoes. The people were delighted of getting the one missing essential to a happy life in the open world, and when, long after, a time came when the world's plenty had pampered their wills and fostered their greed and selfishness to the point of preying upon their fellow-creatures for food, they still had the honour to vow never to eat wolf or squirrel flesh. Neither would they move camp without a live coal among their possessions. And even to-day the Navajoes' gratitude to the trio is observed as the promise made to the fire-getters of the tradition.

Between the Navajoes and different animals there sprang up a dispute over the Great Spirit's intended use for night and day. All agreed that one should be spent in sleep and one in action, but which should serve the one and which the other? It was settled at last. Those that wished to roam at night should do so and sleep by day, and *vice versâ*. The heroic badger was among those who chose the mysteries of the darkness or the immediate dawn and dusk for thought and action, and the bright and sunny hours as fit to be slept away in his cool underground nest. As the sun sank in the west upon their business meeting, the owl, bat, moth, and many other animals scattered out into the valley borders on their foraging exploits, while many kinds of birds flew to roost in the trees. Other animals lay down to sleep in sheltered parts of the forest, and the Navajoes spread their waterproof blankets, the trophies of the women's industry, and enjoyed their couches under the starry sky in peaceful dreams.—*Overland Monthly.*

Gossip.

BY RICHARD A. PROCTOR.

I HOPE to visit England next September, for the winter of 1888–89. Any institutions, societies, &c., or individuals who may wish for lectures from me should address me (without great delay) at Corona Lodge, Orange Lake, Fla.; or communications may be addressed to Mr. John Flack, care of the publishers of KNOWLEDGE.

* * *

A CORRESPONDENT mentions that in a certain game, in which the chances were even, one player won nine times in succession. He and his friends discussed the matter, and one of them afterwards calculated that the odds were 511 to 1 against the observed event. He asks me if this is right. It is, if the question is, What are the odds against one named player winning nine successive games, counting from the one first to be played? If, however, the question be, What are the odds against one or the other player winning the first nine games played? then the odds are only 255 to 1. And if the question be, What are the odds against the occurrence of a run of nine successive wins by one or other player in the course of an evening's play? the odds will be much less—only determinable, however, if the number of games to be played be mentioned.

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THE method of calculation is simple. If the first of the above questions is raised, and A be the player whose chance is to be considered, then the chance that he wins the first game is $\frac{1}{2}$, and the chance that he wins the second considered alone is a'so $\frac{1}{2}$; but as he only has $\frac{1}{2}$ a chance of entering on this second game as a winner of the first, his chance of winning both games is only $\frac{1}{2}$ of $\frac{1}{2}$, or $\frac{1}{4}$. So his chance of winning the third game is $\frac{1}{2}$; but his chance of winning it as already a winner of the first two is only $\frac{1}{4}$ of $\frac{1}{2}$, or $\frac{1}{8}$. Proceeding in this way, we find A's chance of winning the first fours game $\frac{1}{8}$ of $\frac{1}{2}$, or $\frac{1}{16}$; of winning the first five, $\frac{1}{16}$ of $\frac{1}{2}$, or $\frac{1}{32}$; of winning the first six, $\frac{1}{32}$ of $\frac{1}{2}$, or $\frac{1}{64}$; first seven, $\frac{1}{128}$; first eight, $\frac{1}{256}$; and, finally, A's chance of winning the first nine games is $\frac{1}{512}$, or the odds are 511 to 1 against that event.

* * *

THE second question only differs in asking the odds against A or B (one of whom *must* win the first game) winning the remaining eight. The chance, as already shown, is $\frac{1}{256}$; the odds, therefore, are 255 to 1.

* * *

IF a number of games are played, it is easy to see that the chances against the event in question are not so heavy. Suppose, for instance, fifty games are played. Then the run of nine games has a chance of occurring with the first nine, *i.e.* beginning with the first game, or with the second, or third, and so on up to the forty-second game.

* * *

THE particular case mentioned by my correspondent—the occurrence, namely, of nine events of the same kind in succession, where the chances are even at each trial—might be supposed to have occurred when Oxford beat Cambridge in the 'Varsity boat race from 1861 to 1869 inclusive. But the probability is that there was a definite superiority in the Oxford style in those days. And it is to be noticed that when the chance is small for an observed event, assuming the conditions equal, the occurrence of the event leads to a presumption that the conditions are not strictly equal, this presumption increasing in weight as the preponderance of events of one particular kind over events supposed originally to be of equal likelihood grows greater.

* * *

THE *Sidereal Messenger* is not content with the progress of events described in KNOWLEDGE for April last under "Gossip," pp. 138, 139. I considered the editor of that usefully compiled little magazine had no right to drag from the columns of the San Francisco *Examiner* (a paper well known for a certain Californian vulgarity) a controversy which began with the unprovoked publication of rude, mendacious things said of me by Mr. Holden in an "interview." If he did drag these improprieties into a magazine otherwise respectable, though dull, he might at least have put in my own reply to the stream of falsehoods which had trickled from Mr. Holden's pen, instead of introducing that stream undiluted by truth. He thus left me no choice but to write a new reply. (I could not at the moment find the only copy I had of the *Examiner* correspondence, and if I had I should not—for reasons—have been very willing to trust it out of my hands except where I knew very certainly that I should see it again.) My brief reply to the *Sidereal Messenger* did not explain, as my full reply to the *Examiner* had done, that the way in which I had saved Holden's name from rejection had been simply by silence. The fact is, as I said last April, it did not seem *absolutely* necessary to explain in one and the same letter that I regarded a person as utterly unworthy of a certain distinction, and that I had *not* actively supported his name for that distinction. It did not seem to me possible that any man having a modicum of sense combined with some idea of the ways of men of honour would misunderstand so preposterously my remark, that the name of one whom I had described as unworthy would have been rejected with contempt had I not spared him.

* * *

THE fact is, I had been so careful in avoiding any mention of the fellow's wrong-doing, from the day when I found out that it was no mere penny-a-liner who had behaved so badly, but one who mixed with such men as Newcomb, Harkness, Hall, Eastman, and others whom I esteem, that I hold myself entitled to some consideration on account of this silence alone. Among those who read these lines there will probably be some of my friends who were on the Council of the Astronomical Society when the election in question took place. They knew that I uttered no word, offered no suggestion, simply did nothing in regard to the person in question. They knew me well enough to be assured that I am neither foolish enough nor false enough to speak of active support, or to imply the support of actual voting on the Council, when ninety-nine out of every hundred who would hear of such statements would know that at the time I had long since withdrawn from all active participation in the Royal Astronomical Society's business, while most of the ninety-nine would consider little short of shameful any active support of one of whom I think as I do of this person.

* * *

YET this Western editor of a miniature magazine of science in remote Minnesota confidently pretends to suppose that I would select his scarce known pages to add a ridiculous and ineffective untruth to the true and just thongstrokes which I have felt it my duty to inflict on a wrongdoer (after finding ten years of silence misunderstood and unappreciated). He asks me to apologise for what I have not said, and for what, had I said it, would have been no injury at all, whether true or not; while he declines (or probably is unable) to see that what I *have* said implies an estimate of his *protégé's* character which would render injury impossible.

* * *

I IMAGINE the editor of the *Sidereal Messenger* is unable to forgive the circumstance that in an early volume of KNOWLEDGE I had to comment on the poverty of original matter in his little magazine (priced at tenpence !). But he has done better with the magazine since; though it is still rather too much of a compilation, and much too small for its price. He ought rather to be grateful than angry for suggestions which doubtless had their share in causing so noticeable an improvement.

* * *

MR. J. FRASER, author of a new and entirely inadmissible theory about gravity, has remained dissatisfied with the treatment he has received in these columns. It will be remembered that his pamphlet was noticed in KNOWLEDGE for August last, p. 236, and that in KNOWLEDGE for October, p. 282, I had to explain in "Gossip," in response to his appeal to myself personally, that the author of the notice had certainly not, as he supposed, acted with wilful unfairness, while I expressed my all but certainty that there was not even any unconscious unfairness. On carefully reading through the pamphlet, I found that, as I supposed, the notice was perfectly just, Mr. Fraser's theory being absolutely untenable. As I had promised to state in these columns the result of my reading of the pamphlet, *if* I found that Mr. Fraser had really made good his case, I supposed that he would take my silence as signifying that I had failed

to find anything of the sort. It appears, however, that Mr. Fraser thinks I must have been satisfied with his theory, but am prevented from saying as much by some mistaken notion about the way in which the editor of KNOWLEDGE should back friends who had written in these columns, even though he judged them to be wholly in error. So he writes to a gentleman whom he supposes, quite erroneously, to have been acting editor of KNOWLEDGE as well as author of the notice of his pamphlet, in terms implying that he has been most unfairly treated.

* * *

Now all this is in exceedingly bad taste—to put the matter very mildly indeed. If my friend had been both author of the notice and acting editor of KNOWLEDGE, it would have been quite improper to address him personally about a notice which he had written in discharge of duties which belonged to the position he occupied. (To appeal to me, as Mr. Fraser had done earlier, was still worse; but, as I had heard the appeal, and had indicated my opinion, to renew the charge of unfairness was doubly insulting—insulting alike to me and to my friend.)

* * *

If paradoxists choose to send their lucubrations to KNOWLEDGE, they must accept the opinions expressed here about them as decisive so far as KNOWLEDGE is concerned. They are free to go about denouncing KNOWLEDGE as incompetent or unjust. If they can make their theories acceptable to the scientific world, their abuse of KNOWLEDGE will very likely be accepted along with those theories. But they have no right to send their abuse to us as well as their paradoxical pamphlets, or to complain because we have given the opinion they have shown themselves anxious to obtain.

* * *

I do not feel bound to repeat or explain my opinion or the opinion of my friend who noticed Mr. Fraser's pamphlet. But as it seems he is not satisfied that I really think his theory unsound, and as he evidently believes I have not noticed the arguments by which he considers he has met objections, I may as well tell him that I do and have. He regards "heat" as the cause of gravity, and cannot see that what we know about the nature and rate of transmission of heat is entirely inconsistent with what we know about the nature and especially about the rate of transmission of gravity. He makes a wild yet feeble attempt to show how heat would act *through* the planets and suns, coming out on the other side; and he supposes he has made it clear that the influences (purely imaginary) which he attributes to heat-waves would be proportional to the masses, not to the surfaces of bodies producing them; but the proof does not merit serious disproof. He has an idea that the great difficulty about gravity resides in the shortness of the time occupied in traversing the distances between the heavenly bodies, so he triumphantly points out that no time at all would be required by his bombarding waves to reach the bodies acted upon, since they are travelling about all the time. The question is not one of time, however, but of velocity. It takes no time for a person travelling along in a rain storm to receive the rain which he encounters at the moment of his arrival at any place; yet his velocity combines with the velocity of the falling rain to affect the apparent direction in which the rain falls on him. What we *know* about gravity is that the velocity of its transmission almost infinitely exceeds the velocity with which the planets travel, and is *many times greater than the velocity of light and heat.*

* * *

Reviews.

The Geological History of Plants. By Sir J. W. DAWSON. (Kegan Paul, Trench, & Co.)—This is a valuable addition to the International Scientific Series. An introductory chapter is fitly occupied with the general facts of geological chronology and the classification of plants, while the body of the work supplies in convenient compass a summary of the development of the successive floras, the typical vegetation of each period being admirably illustrated. We may direct special attention to those portions of the seventh and eighth chapters which, in treating of plant origin and migrations, discuss the interesting question of the appearance of specific types in Arctic latitudes, "the full significance of which," Sir William Dawson remarks, "seems only recently to have dawned on the minds of geologists." Sir William might have added that the paramount importance of the study of plants, as contrasted with that of animals, in organic evolution, "seems only recently to have dawned" on biologists.

A Course of Lectures on Electricity. By GEORGE FORBES, M.A., F.R.S., &c. (London: Longmans, Green, & Co. 1888.)—This admirable series of lectures is based upon the notes of five which were delivered by Mr. Forbes before the Society of Arts in 1886, while the sixth (on Dynamo-Electric Machinery) is a reprint of a paper read at the Electrical Exhibition at Philadelphia in 1884. As a trustworthy introduction to electrical science, as developed experimentally by Faraday, and subsequently mathematically by Clerk Maxwell, it would be hard to surpass. Plain and popular in language, but throughout scientifically accurate, the fairly well-educated reader who gains his first introduction to electricity through its pages will find, after an attentive perusal of them, that he has acquired a sound knowledge, not only of the principles of the science, but also of the manner in which it is practically applied in electric lighting, the telegraph, the telephone, and in the arts generally. No sounder and better rudimentary treatise on the subject of which it treats has, so far, appeared. Seventeen well-executed woodcuts supply all that is needed in the shape of illustration.

A Student's Manual of Psychology. By FRIEDRICH KIRCHNER. Adapted by E. B. DROUGHT. (London: Swan Sonnenschein, Lowrey, & Co. 1888.)—Wading painfully through this volume, we are amazed that its author can have contrived to render a subject so replete with interest as psychology so horribly dull and wearisome. To read it after perusing such works as Bain's "The Senses and the Intellect" and "The Emotions and the Will," or Carpenter's "Mental Physiology," is like turning from an essay by Elia to "Drelincourt on Death" or Hervey's "Meditations among the Tombs." This is the more regrettable as the author's obvious erudition is supplemented by that thorough plodding painstaking so essentially characteristic of the German scholar. A large part of the dissertation "On the Nature of the Soul" seems to us the veriest logomachy.

The Playground of Science. By JOHNSTON STEPHEN. (London: Truelove & Shirley.)—Every student of physics knows how much more he learns from experiments actually performed by himself than from any amount of mere reading. Acting on this admitted principle, Mr. Stephen, in the capital little shilling's worth before us, gives plain directions for the performance of sixty-nine experiments, illustrating the phenomena of sound, light, heat, electricity, magnetism, pneumatics and hydraulics, statics and dynamics, with descriptions of the mode of constructing the extremely simple apparatus needed for their demonstration. All of

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them ingenious and some of them new, these cannot fail to give any intelligent boy or youth sound ideas on the subject of elementary physics, and for this purpose Mr. Stephen's little book may be confidently recommended.

Volapük, or Universal Language. By ALFRED KIRCHHOFF. (London: Swan Sonnenschein, Lowrey, & Co. 1888.)—*Key to the Volapük Grammar.* (Same Author and Publishers)—Whether a universal language is attainable, or even desirable, may reasonably be a subject for discussion; but that "Volapük" will ever become that language is in the very highest degree improbable. Mediævally, Latin was the means of communication among scholars of all nationalities, as to-day French is the language of diplomacy; but if any form of world-speech is now to be adopted, by far the simplest plan would be to select the existing language spoken by the greatest number of civilised men, and adopt *that* as the common vehicle of thought among the different nations of the earth. It needs no superhuman acumen to determine what that language must, *ex necessitate*, be. Herr Kirchhoff, however, in this matter assumes the attitude of the militiaman, who, being reminded by his left-hand man that he was out of step with the entire battalion, retorted, "Change yourn, then!" We gravely doubt whether he will get many Englishmen to take the trouble to master his grotesque and cacophonous new language, at a time when their own mother-tongue is so rapidly spreading in every part of the habitable globe.

Discursive Essays on the Phenomena of the Heavens, &c., &c., &c. By COSMOPOLITES. (London: London Literary Society.)—An evil fashion has sprung up of late years among book compilers which deserves exposure. It pertains mainly to the school of cosmogonists, and gentry who come forward with theories more or less new (and more rather than less, idiotic) of the physical structure and dominant forces of the universe. These people, unprepared by previous mathematical and physical training, begin by sedulously cramming up the contents of a few books on popular science, whose facts they empty wholesale into their pages; and then, upon this foundation, build their own preposterous theories. If any one ventures to criticise their nonsense, the stock answer is that their facts are irrefragable, as though the granting of this postulate carried with it the admission that their inferences must be also! Of (what we may perhaps call, without offence,) this Kinnsian style of argument (?), "Cosmopolites" is seemingly one of the latest exponents. When we say that he sets forth as an "axiom" that "every atom of matter in the solid, fluid, or gaseous state throughout the entire universe, contains the essence, or principle of heat, of which light is an emanation, a quality, or manifestation" (page 47); that he treats cold as an actual entity and not as the mere absence of heat; that he regards certain aërolites as actually formed in our own atmosphere—and so on, and so forth, we feel that we should not be justified in further trespassing upon our readers' time by any detailed criticism of these well-named "Discursive" Essays.

Lockwood's Dictionary of Mechanical Engineering Terms. (London: Crosby Lockwood & Co. 1888.)—This carefully compiled volume forms a kind of pocket cyclopædia of the extensive subject to which it is devoted, and will be found useful alike to the artificer and to the amateur reader of technical works on mechanical manipulation. No word having connection with any branch of constructive engineering seems to be omitted; and, while we find a short article on the "Occlusion of Gases" on p. 236, the author does not omit to define with equal care, on p. 377, so familiar an object in the workshop as a "Tommy"; the meanings of "Unit of Heat" and "Jim Crow," too, alike finding their places in his pages. No more comprehensive work has been, so far, issued.

The Genesis of Federation. By MAURICE H. HERVEY. (Sydney: John Sands. 1887.)—Mr. Hervey has a magnificent scheme for the federation of all colonies, states, dominions, and dependencies which at present acknowledge British rule; but as it comprehends, *inter alia*, the division of the United Kingdom into four autonomous states of England, Ireland, Scotland, and Wales, we need not discuss it here.

Internationales Archiv für Ethnographie. Band I. Hefte I. and II. (London: Trübner & Co.)—The first two parts of what promises to be a work of the highest value to the ethnographer and anthropologist lie before us. Few persons have any conception of the vast amount of unemployed material in the shape of ethnographical collections which reposes upon the shelves of so many museums, and it is to render this available to the scientific public that the present series has been projected. Each part contains a series of detached essays on the various branches of the subject to which the work is devoted; the principal paper in the first part being devoted to New Guinea, and the corresponding one, in the second, to Liberia. Nothing more beautiful than the coloured illustrations of weapons, instruments, and implements has appeared for a very long time.

The Asclepiad. By B. W. RICHARDSON, M.D., F.R.S. (London: Longmans, Green, & Co. 1888.)—Once again we welcome the quarterly number of Dr. Richardson's excellent and valuable serial. As we have formerly had occasion to remark, while primarily addressed to the medical profession, it is almost impossible to find a part destitute of matter of interest to the ordinary reader. To take the one before us as an illustration: it contains an article on embalming, and a biographical sketch of the famous Dr. Mead, who introduced inoculation into this country, stood by the death-bed of Queen Anne, and was physician to George II. Assuredly this capital contribution to medical literature exhibits no sign of decadence.

Cassell's Technical Educator. (London: Cassell & Co.)—If we are to accept the loudly-uttered assurance that the future commercial salvation of this country depends upon the spread of technical education, then surely the Messrs. Cassell deserve our gratitude for their efforts for its advancement. Nothing more comprehensive than the work before us has, so far, appeared. In fact, were we disposed to cavil, we should be tempted to object that it is really *too* comprehensive, embracing, as it does, fortification! among the extremely diverse subjects of which it treats.

Among the pile of educational books which crowd our table may be mentioned *Physiology*, by J. M'GREGOR-ROBERTSON, M.A., and *Dynamics and Hydrostatics*, by R. H. PINKERTON, B.A., two of Blackie's excellent Science Text-books. (London: Blackie & Son. 1888.) Both well written and illustrated: the *Physiology* excellently and profusely so. *Physiography*, by W. MAWER, F.G.S. (London: John Marshall & Co. 1888); *Elementary Physiography*, by JOHN THORNTON, M.A. (London: Longmans, Green, & Co. 1888), into which, and notably in the case of Mr. Thornton's book, a great deal of information is packed.—*Practical Essay Writing*, by A. W. HOLMES-FORBES, M.A. (London: Swan Sonnenschein, Lowrey, & Co. 1888), containing much that must be useful to the imperfectly crammed competitor in an "Exam."—*A Pupil Teacher's Handbook of Arithmetic*, by Rev. A. D. CAPEL (London: Joseph Hughes. 1888). Cheap and sound.—*French Course*, by G. H. WILLIAMS, M.A. *The Art Student's Second Grade Practical Geometry*, by JOHN LOWRES, revised by GEORGE BROWN *Moffatt's Selected*

Inspector's Arithmetic Questions, Standards III., IV., V., VI., and VII. *Moffatt's Geography of the British Empire.* (London: Moffatt & Paige.) Of which Mr. Williams's work seems to be designed on a common-sense plan, and the others to fulfil the purpose for which they were compiled. Also from the same publishers—*How to Prepare Notes of Lessons*, by T. J. LIVESEY; *The Earth and the Solar System*; *The Ocean*; *How to Teach Reading*, by T. J. LIVESEY; *English Grammar*; and *Time Drill.* All useful to teachers in elementary schools.—From Messrs. Relfe Brothers we have *First Principles of Modern History*, by T. S. TAYLOR; *How to Spell and Speak English*, by M.A. Cantab.; and *Dates made Easy*, by J. H. HAWLEY.—From Messrs. Swan Sonnenschein, Lowrey, & Co., *A First History of the English People*, by AMY BAKER, the second volume terminating with the reign of Elizabeth; and from Mr. David Nutt, *Simon de Montfort and his Cause*, by Rev. W. H. HUTTON, M.A., each of the works specified being a more or less successful attempt to render history digestible to the youthful mind.—*A Plea for Training the Hand* (New York Industrial Education Association. 1888), which might be read with profit by those who are urgent to grossly misuse Board Schools by teaching French, &c., in them; as pointing out a more excellent way of employing the spare time of children who must subsequently live by their own labour.—*Moffatt's Deductions from Euclid.* (London: Moffatt & Paige.) Handy for testing the student's comprehension of the problems and theorems of the mighty Alexandrine geometer.—*Education, Science, Geology.* By H. P. MALET. (London: Farmer & Sons. 1888.) Unworthy of serious criticism; and *Education in Bavaria.* By Sir PHILIP MAGNUS. (New York. 1888.) A clever attempt to persuade the British taxpayer further to endow the South Kensington ring.

Among the literary odds and ends on our table are: *Physical Geography of Mountains and Rivers.* By THOMAS PAIGE. (London: Moffatt & Paige.) Useful to the beginner.—*A National Canal Between the Four Rivers a National Necessity.* By SAMUEL LLOYD. A scheme for promoting English prosperity by uniting the Thames, the Severn, the Mersey, and the Humber.—*The Natural Law of Relation between Rainfall and Vegetable Life and its Application to Australia.* By FRANZ A. VELSCHOW, C.E. Which develops the theory that deserts have a "cushion" of air over them which effectually buoys up rain-clouds, and prevents them from ever discharging their contents.—And the *Reports of Excursions during the Summer of* 1887 made by the London Geological Field Class under the direction of PROFESSOR H. G. SEELEY. (London: Geo. Philip & Son. 1888.) Short, thoroughly practical, and useful to the field geologist.

THE FACE OF THE SKY FOR JUNE.

By F.R.A.S.

THE student may continue to watch the sun for the small spots which appear at distant intervals. Midnight, on June 20, is the date of the summer solstice, and the 21st is the date of the "longest day." There is no real night this month in any part of Great Britain. Map vi. of "The Stars in their Seasons," shows the face of the night sky. Mercury, as an evening star, is capitally placed for the observer, and may be well seen without instrumental means, after sunset, over the N.W. by W. part of the horizon. Towards the end of the month he presents a pretty little crescent of over 11″ in diameter. On the 12th, when at his greatest elongation east of the sun, he will be a little more than 1° north of δ Geminorum ("The Stars in their Seasons," map ii.). Venus is a morning star, and is approaching the sun. She is but poorly placed indeed for the observer. Mars is approaching the west and should be looked for as soon after sunset as he is visible. His angular diameter continues to diminish, and it requires a pretty powerful telescope to detect much detail on his surface. He will be found in Virgo ("The Stars in their Seasons," map v.). Jupiter's position is improving a little; but he still has considerable (though decreasing) south declination. He should be observed when close to the meridian. He is in Libra ("The Stars in their Seasons," map vi.) throughout the month. The phenomena of Jupiter's satellites observable at convenient hours during June are as follow:—Satellite i. will be occulted on the 1st at 10h. 52 P.M. On the 2nd, satellite i. will pass off Jupiter's disc at 10h. 12m. P.M.; followed by its shadow at 10h. 29m. P.M. On the 6th satellite ii. will disappear in occultation at 10h. 36m. P.M.; as will satellite i. 37 minutes after midnight on the 8th. On the 9th, the transit of satellite i. will begin at 9h. 44m. P.M.; as will that of its shadow at 10h. 11m. The satellite will leave Jupiter's opposite limb at 11h. 56m. P.M., and the shadow 23 minutes after midnight. On the 10th satellite i. will reappear from eclipse at 9h. 40m. 31s. P.M. On the 13th satellite ii. will be occulted at 12h. 53 P.M. The egress of this same satellite from the face of the planet will happen on the 15th at 10h. 18m. P.M., and it will be followed by its shadow at 11h. 29m. On the 16th the transit of satellite i. will begin at 11h. 30m., as will that of its shadow at 12h. 5m. P.M. Satellite i. will reappear from eclipse at 11h. 34m. 51s. P.M. on the 17th, as will satellite iii. from occultation at 10h. 25m. P.M. on the 18th, only to suffer eclipse later at 11h. 15m. 38s. On the 22nd the transit of satellite ii. will begin at 10h. 6m. P.M., and that of its shadow at 11h. 33m. The satellite will pass off Jupiter's face 35 minutes after midnight. On the 24th satellite i. will be occulted at 10h. 34m. P.M. On the 25th the egress of satellite i. from Jupiter's limb will happen at 9h. 55m., and that of its shadow at 10h. 42m. P.M. Finally, 4 minutes after midnight satellite iii. will be occulted. Saturn has left us until the end of the year. Uranus is rapidly approaching the west, and to be seen at all must be looked for the moment it is dusk. He is situated between Spica and γ Virginis ("The Stars in their Seasons," map. v.). The moon enters her last quarter 53·4 minutes after noon on the 1st, is new at 4h. 34m. P.M. on the 9th, enters her first quarter at 6h. 49·7m. on the morning of the 17th, and is full at 9h. 7·5m. in the evening of the 23rd. The sole occultation of a star visible during June at a convenient hour is that of 50 Sagittarii on the 24th. The star, which is of the 6th magnitude, will disappear at the bright limb of the moon at 10h. 6m. P.M. at an angle of 65° from her vertex, and reappear at her dark limb at 11h. 16m. P.M. at an angle from her vertex of 250°. At noon to-day the moon is in Aquarius, which constellation she quits for Pisces at 9h. A.M. on the 2nd ("The Seasons Pictured," plate xxii.). In her journey through Pisces she passes into Cetus at 3h. A.M. on the 3rd. At 1 P.M. on the 4th she emerges from Cetus and re-enters Pisces, which she quits for the second time for an outlier of Cetus at 10h. A.M. on the 5th. When she finally leaves this constellation at 8h. A.M. on the 6th, it is to come out in Aries ("The Seasons Pictured," plate xxii.). Her passage over Aries is completed by 7h. 30m. A.M. on the 7th, at which hour she crosses the boundary into Taurus. She is journeying across Taurus until 7h. A.M. on the 10th, and then reaches the most northerly part of the northern prolongation of Orion. By 5 o'clock that same afternoon she has crossed this and come out in Gemini ("The Seasons Pictured," plate xxiv.). Here she remains until 4h. P.M. on the 12th, when she enters Cancer. She is travelling through Cancer until 6h. 30m. A.M. on the 14th. She then passes into Leo, there she continues until 10h. P.M. on the 16th, crossing the boundary at that hour into Virgo ("The Seasons Pictured," plate xxv.). She is travelling through that great constellation until 11 P.M. on the 19th, when she leaves it for Libra. As she journeys across Libra she arrives at 4h. P.M. on the 21st, at the western edge of the narrow northern spike of Scorpio ("The Seasons Pictured," plate xxvi.). By 1 o'clock next morning she has crossed this and come out in Ophiuchus. Hence she passes into Sagittarius at 1h. P.M. on the 23rd. At 5h. P.M. on the 25th she has traversed Sagittarius, and is entering Capricornus. She leaves Capricornus for Aquarius at 2h. P.M. on the 27th ("The Seasons Pictured," plate xxi.), and Aquarius in turn for Pisces at 5h. P.M. on the 29th ("The Seasons Pictured," plate xxii.). As at the beginning of the month, she arrives in the confines of Cetus at 10 A.M. on the 30th, and is still in Cetus when these notes terminate.

THE name of Dollond (optician) has been associated with St. Paul's Churchyard for the past 135 years, and until just lately had no other place of business in London. It will be interesting to City men to know that Dollond & Co. have now opened a branch establishment nearly opposite the City of London Club in Old Broad Street, over which one of the partners of the firm presides.

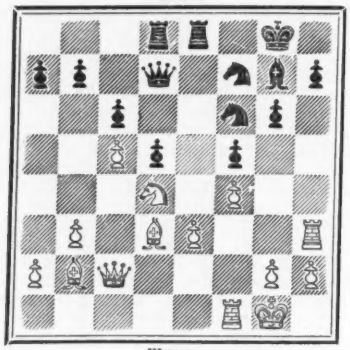
XUM

Our Chess Column.

BY "MEPHISTO."

THE following position occurred in the deciding game of the match between Mr. Burn and the Rev. J. Owen for the Rutherford Challenge Cup:—

A. BURN.
BLACK.



WHITE.
J. OWEN.

It was White's turn to play, and the game continued: —

WHITE.	BLACK.
1. Kt × KBP (*a*)	1. P × Kt
2. B × P	2. Q to B2 (*b*)
3. B × P (ch)	3. K to Bsq
4. Q to B5	4. Kt to R4 (*c*)
5. B to K5 (*d*)	5. B × B
6. P × B	6. Kt to Kt2 (*e*)
7. Q to B4	7. R to Q2
8. B to Kt6	8. K to Ktsq (*f*)
9. Q to KR4	9. Q × P (*g*)
10. B × Kt (ch)	10. K to Bsq
11. B × R (dis. ch)	11. K × B
12. Q to R8 (ch)	12. K to K2
13. Q to B8 (ch)	13. K to K3
14. R to R6(ch)	14. Resigns.

(*a*) Fine play! If Black refuses to take the Kt, White by playing Kt to R4 evidently gets a strong attack with a pawn ahead.

(*b*) The alternative move is 2. Q to K2.

(*c*) If 4. Kt to Q2, then 5. B to Kt6. If 4. Kt to Ktsq, 5. B × B (ch), and 6. Q to Kt6 (ch), &c., 4. Kt to K5 was probably best.

(*d*) A good move, which forces the opening of the KB file for the rook

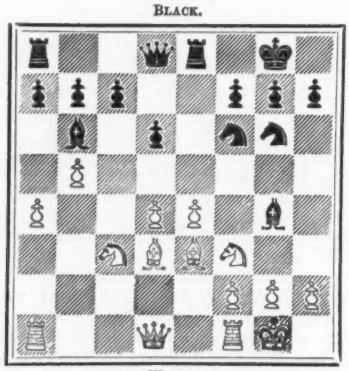
(*e*) If 6. R × P. 7. Q to Kt4; Kt to Kt2. 8. B to Kt6 winning.

(*f*) To guard against the mate by 9. R to R8 (ch).

(*g*) Black cannot save the game, and now the mate is forced in six moves. The ending is a remarkable example of the way an apparently sound and strong position may be shattered.

Position between the same players arising from an Evans declined:—

A. BURN.
BLACK.



WHITE.
J. OWEN.

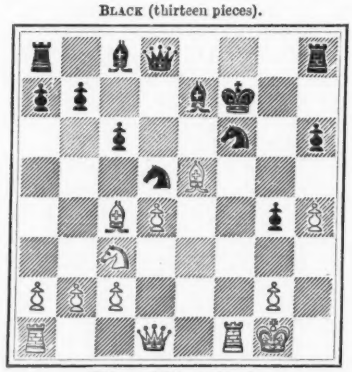
The game terminated as follows:—

	13. B to QR4
14. Kt to K2	14. Kt × P
15. B × Kt	15. R × B
16. Kt to Kt3	16. R to Ksq
17. P to KR3	17. B to Q2
18. Kt to Kt5	18. R × B
19. Q to R5	19. R to Ksq
20. Q × P (ch)	20. K to Bsq
21. Kt to R5	21. Q × Kt
22. P to KB4	22. Q to R3
Resigns.	

The following very interesting variation, which arises from the Hampe-Algaier-Thorold Opening, is brought about in a natural way, and its frequent occurrence in practical play being very probable, the useful knowledge may be applied as the pleasurable occasion arises:—

WHITE.	BLACK.
1. P to K4	1. P to K4
2. QKt to B3	2. QKt to B3
3. P to B4	3. P × P
4. Kt to B3	4. P to KKt4
5. P to KR4	5. P to Kt5
6. Kt to KKt5	6. P to KR3
7. Kt × P	7. K × Kt
8. P to Q4	8. P to Q4
9. P × P	9. QKt to K2
10. B × P	10. Kt × P
11. B to B4	11. P to B3
12. B to K5	12. Kt to B3
13. Castles KR	13. B to K2

BLACK (thirteen pieces).



WHITE (thirteen pieces).

In this position White has the choice of two moves. The first by which he can recover his piece, leads to the following play:—

14. B × Kt; B × B. 15. Kt to K4; K to Kt2. 16. B × Kt; R to Bsq. 17. Kt × B; R × Kt. 18. R × R; Q × R. 19. B to B4, or Kt3, &c. But the other move is 14. Kt to K4, which brings about very pretty play, and gains a winning advantage, *i.e.*—

14. Kt to K4	14. K to Ksq

If the King does not move, then of course B × QKt, followed by Kt × Kt, with a winning attack.

15. B × QKt	15. Kt × B
16. B × R	16. Kt to K6
17. Q to K2	17. Kt × R
18. Kt to B6 (ch)	18. K to B2
19. R × Kt	19. Q × B
20. Kt to Q5 (disc ch)	

with a winning attack. The only remaining feasible move for Black is K to Kt3, and this brings about some very pretty play as follows:—

14. Kt to K4	14. K to Kt3
15. Q to Q3	15. Kt to Kt5

This is the only move to prevent an early mate by a discovered check, but White can now win in the following pretty manner:—

16. Kt × Kt (disc ch)	16. Kt × Q
17. P to R5 (ch)	17. K to Kt2

If K to Kt4, then White mates in three by Kt to K4 (ch).

18. Kt to K8 (ch)	18. K to R2
19. R to B7 (ch)	19. K to Ktsq
20. QR to KBsq	

and Black cannot avoid the mate in a few moves.

Our Whist Column.

By "FIVE OF CLUBS."

DECISIVE PLAY.

THE following case, which occurred at play a few evenings since, shows the advantage of prompt decision at whist, and how considerations of whist strategy sometimes render it desirable to run dead counter to accepted canons.

I was the dealer (Z), and turned up the heart ace; in my hand I found two small trumps, diamond ace, queen, ten, and two little ones; spade king, queen, and a little one; club ace and a little one.

The score was—A-B, three; Y-Z, two.

A led a trump, Y played a small one, B put on the knave. The heart ace was the natural card to play under the circumstances. Half a dozen rule-reasons could be cited. A, having led trumps, wanted trumps returned, and, playing the ace, would stop that for the moment. If trumps were returned, B would be leading through Z's honour. Trump strength being with the enemy, it was desirable, according to the usual rule, to show the enemy as little as possible about the position of the remaining trumps. And so forth, and so forth.

But I played a small trump, feeling—against all cut-and-dried rules—that my double tenace in diamonds, with re-entering cards in spades and clubs, made that play at least safe, while there was a fair chance of scoring freely. Moreover, A having led trumps, it was quite likely that A-B held between them two by honours, in which case nothing but forward play could save us as the score stood.

B returned trumps; I passed, A taking the trick, and third round falling to my ace: my partner discarded a diamond. (I knew this to be his shortest suit, because I could depend on his recognising my play as emphatically indicating all-round strength; so that the cut-and-dried rule to discard from the longest suit in presence of the enemy's trump lead would not influence him as against the obvious requirements of strategy.) Two by honours were now declared against us, and the chance of defeat seemed heavy. Yet my play would probably save us a point, even if we were defeated. I led my fourth best diamond—not, as rule would require, the ace; for on the line I was following everything depended on keeping re-entering cards to the last. Y took the trick with the knave, and returned a small one. As nine had fallen from A, I knew that his king must fall this round to my ace; otherwise I should have been tempted to play the queen in order to make sure of the entire command of the suit—for a king left in A's hand after my ace was played would have stopped my long suit effectually. (This, however, would have been giving up all chance of game for the certainty of saving only a point.) I next led the queen, which A of course trumped. All the diamonds outside my hand fell to this round. A led a small spade, and the trick fell to my queen—on B's ten. My diamond ten drew A's last trump. A led another small spade. My partner, who held the ace, nine, and two little ones, played a small one, knowing the king must be with me. I made my long diamond—the deuce—and my club ace, then led a spade, knowing my partner must hold the ace and probably the nine. His major tenace in A's suit being thus led up to, he made the remaining tricks.

Thus A-B made only four tricks, though A held king, queen, ten, nine, eight of trumps, knave and three small spades, king and queen of clubs, and guarded king of diamonds; while B held knave and two small trumps, and knave, ten, nine of clubs. A-B did not make a single trick in their plain suits, though holding two kings, two queens, two knaves, two tens, and two nines—out of three.

Y-Z scored four and the game—which, as it chanced, decided a rubber.

DOUBTFUL LEAD.

The able whist editor discusses the question of the right original lead from—ace and two trumps (hearts); ace, queen, ten, and two small clubs; king and three small diamonds; and spade queen. [I quote from memory, having mislaid the cutting: but the hand is right, though the suits may be wrong.] He considers that, although the lead of the club ace would be usual and not to be blamed, the lead of spade queen, as giving on the whole fullest information to partner, would be more effective. I cannot agree with him. It seems to me the immediate declaration of weakness in spades would be apt to have a most damaging effect. For my own part—but I am rather a venturesome trump-leader—I should be apt, unless playing for the odd trick, to take out two rounds of trumps. But I believe the best lead would be the penultimate (original fourth best) club. Partner, on recognising that, though holding ace to five, the original leader had not led it, would see that he was holding it as a card of re-entry, and would lead trumps if strong enough to back up the leader's manifest strategy: king of diamonds and even queen of spades would be possible cards of re-entry.

SCIENCE IN WHIST.—AN ANGRY LETTER.

Mr. Francis Ram writes me a very angry (I might almost say an abusive) letter, asking if I imagine the readers of these columns will not recognise the unfairness with which he has been treated. He in effect asserts that I quoted his first letter in full only because I expected to get an easy victory over him, and left his last unquoted because I found I was getting the worst of the discussion.

I have to apologise to the readers of these columns for quoting at all—in a magazine called KNOWLEDGE—from a letter written on a subject about which our correspondent professedly has at present no knowledge. But it so chanced that the letter reached me just as I was putting the finishing touches to an article on the science of whist, and seemed so singularly apropos that I put it at the head of my article, and by sundry touches made the article read like a commentary on the text supplied me by Mr. Ram (KNOWLEDGE for December 1887). I inserted (KNOWLEDGE for January 1888) Mr. Ram's reply, which was, however, in fact no reply at all, as he simply dwelt on the fact that chance plays a more important part in whist than in chess, which every one knows—the real fact being, however, that it is through the part chance plays in whist that the game derives its most essentially scientific characteristic.

The matter may be presented in abstract thus:—

Mr. Ram, carefully showing that he knows nothing of science in whist, denies its existence, and asserts that success comes as freely to the bumble-puppist as to the man who fancies he is playing a scientific game. I endeavour to make it clear to him and others that (passing over his mistake in writing, too, without knowledge to KNOWLEDGE) (1) there is science in whist; (2) science tells, as statistics show; and (3) the scientific game is a game worth playing, whereas the pure chance game of playing out winning cards and leaving the adversary to make theirs is not worth the trouble of sitting down to. (Have I not played it? And do I not know its utter dreariness? I have also in childhood's hours played "Beggar my Neighbour," and I know not which game is the slowest.) Mr. Ram reiterates his opinion that "play in whist is necessarily a mere muddling along," and asks how often in chess bad play will succeed against good play—comparing a subject of study with a recreation.

Mr. Ram's failure to understand how the very chances in the game of whist add to its scientific character would show, if the fact had not been already clearly indicated, that he has not yet entered the charmed and charming circle about the mysteries within which he nevertheless insists on speculating.

Let me illustrate the matter by two examples—one telling of a successful achievement of mine, in which chance played a part; the other of a bad mistake, for which I was deservedly punished:—

1. The first case is the game described above. Here I adopted in the first round a course which would certainly never have suggested itself to a bumble-puppist, and I was guided thereto solely by a consideration of the chances. I held an honour myself, and an honour had fallen on my right; the leader had either led (in all probability) from five trumps or from four trumps two honours. In the latter case the enemy would certainly go out in honours unless we could make three by cards, and would count a double unless we could make the odd trick. In the former case the leader still held four trumps out of the nine whose position remained unknown, and it was therefore more likely than not that of these nine cards the two honours were in the hands of the enemy. As I had myself great strength in plain suits, it was rather more likely than not that A's lead was rather from great trump strength than from combined strength in trumps and plain suits. For this reason I passed the first trick, thereby showing my partner (a keen player) that he must play as knowing I held great strength in plain suits, for nothing else would explain my holding back the ace, which was the trump card. The rest of the play, as above described, depended throughout on the line I had thus adopted. (My partner would have discarded a spade to the third round of trumps but for my declaration of strength—and a single spade thrown from his hand would have meant the loss of the game to us.)

2. The second case is one I am somewhat ashamed of; but readers of these columns are entitled to the lesson it teaches. I had got out all the trumps, including my own, and remained with

king, queen, and a small heart, and a king-card in clubs. (I had already made my long spades, and we were now playing out the fag end of the hand; hearts had not yet been led, though three hearts had been played.) I knew perfectly well that the chances were in favour of the correct lead—heart king, and that nothing in the lateness of the suit affected the propriety of the lead. We had made the odd trick already, and if my partner held the ace, we should make all four tricks and go out; but if the enemy held it, we might make three tricks, two, or one out of the remaining four. Leading king ensured two; and though leading a small card gave a chance of three, the chance of three was not equal to the certainty of two, which was thrown away by leading the king. As we wanted four tricks to save the game—for the enemy had shown two by honours, and were at the score of three—making three more tricks which would have brought our score to "four," and made the game a "single" to the enemy, was not worth more than making two. Despite all this, which should have been obvious, I played the small heart, for the chance of making three of the remaining tricks. Ace lay on my left, however, and the trick fell to heart ten on my right. Club was led, and my king-card made. I had then to lead heart king, which fell to the ace, and the deuce of clubs being led took the last trick. The enemy scored a "double" and the rub.

Of course this was sheer bad play on the part of one who knew the right course. It was due to inattention to the score first, and secondly to misjudgment of the chances. But the bumble puppist, placed in my position, would play the small heart every time. The only difference would be that he would play the king card in clubs first, thereby making the chances worst, for want of a re-entering card to bring in the king and queen, which he had been nursing so carefully.

That scientific whist-players are at issue on some minor points (the more serious differences in regard to the signals have no relation to the science of the game, only to its qualities as a recreation) proves only that some of the problems involved in the game are very difficult. Considering that the possible hands are to be numbered by hundreds of thousands, it is not to be wondered at that in some cases there is great difficulty in deciding what is the proper course. Let any one consider, for instance, all that is involved in the problem whether second player holding king and two others should put the king or queen led. Not only are there all the chances to be considered in regard to the making of tricks in the first two rounds of the suit, but the question whether it is more important to make sure of as much on these rounds as can be made, or to hold the command till the third round, and so prevent leader from making long cards in the suit. This again depends on a number of considerations—as on the possession of command in other suits, on the probabilities as to partner having such command, &c. &c. For my own part, considering this particular point only, I wonder less that there should be difference of opinion than that any player who knows the game should undertake to lay down a definite rule at all, where the primary chances are so equally balanced that very slight differences in the circumstances may make one course the better or the other.

MATHEWS ON WHIST.

THE FINESSE.

In playing for the odd trick few finesses are justifiable. This is a nice part of the game, and experience, with attention, will alone teach it with effect.

Finessing in general is only meant against one card. There are, however, situations when much deeper finessing is required; but theory alone can never enable the beginner to learn these. As an illustration, suppose it is necessary you should make two out of the last three cards in a suit not yet played, and you hold ace, ten, and a small one; if your partner leads the nine, how should you play? The proper course is to pass it, even though in so doing you are finessing against three cards, for if your partner has an honour in the suit you make two tricks, and if not you cannot make two tricks by any mode of play whatever.

As the following, or nearly similar, situations frequently occur, I recommend them to the attentive study of those players who, feeling within themselves that they comprehend what may be called the alphabet of whist, desire to procure a gradual insight into the game, all the combinations of which, I cannot too often repeat, proceed from very plain and simple principles. It requires some reflection, however, to recognise the truth of the same maxim, when applied to inferior cards, which appears self-evident in the case of higher cards. Thus there is scarcely a player who, if he has the ace, king, knave of a suit of which his right-hand adversary has turned up the queen, but will lead the king and wait for the return of the suit to win with his knave. [Mathews says to finesse his knave, but there is no finesse.] But with ace, queen, and ten—the knave being turned up on his right hand—the same player will often fail to see that his lead, if he plays a trump, is the queen, and that one and the same principle actuates the play in both cases: and so through the suit.

Should your left-hand adversary lead the king from ace, king, knave, to have the finesse of the knave, and it comes to your lead, it is evident the finesse will succeed, if you remain with the queen and one more. In this case play the small one through him, as this frequently prevents him from making the finesse, though he originally played for it.

If left with the last trumps and some winning cards, with one losing one, play the losing card first, as your adversary on the left may finesse; and if the second best is in your partner's hand it may make the trick—which cannot be made if you leave the trick to the last.

Finesses are generally right in trumps, or in a plain suit if you are strong in trumps; otherwise you should be cautious in finessing.

NOTE.—In our next we shall complete our rearrangement of "Mathews on Whist." There remain at present but a few paragraphs on playing to the score, some considerations relating to end play (a few examples), and some paragraphs relating to "the call," and other points belonging to long whist. I must confess that in going through Mathews (which has been a rather laborious task, owing to the entire absence of order in his work, and his confused style of writing) I have been strongly impressed with the close correspondence between good whist in his day and good whist in our time. There have been considerable changes in matters conventional, but the changes in regard to strategy have been very slight indeed. Some of the suggested changes seem to me far from being improvements, especially the discard from the best suit in presence of the enemy's trump lead, instead of the old rule to discard in that case where you can spare a card best or with least risk—that is, generally, from a well-protected suit (though where you have perfectly useless cards in a suit, one of those should be thrown away rather than diminish your protection, even in a well-protected suit).*

DESTRUCTION WROUGHT BY INSECTS IN AMERICA.—The annual loss to productive industries in the United States caused by insects is estimated at 150,000,000 dollars. Here is a fair battle between man and another sort of earth occupiers. They are smaller, but if they can whip us have undoubtedly as good a right to the world as we have. As civilisation advances new insects make their appearance, marching sometimes eastward, but generally westward. There are few, if any, forms of vegetation that have no parasites that devour either foliage or fruit. The loss to the cotton crop is estimated at 15,000,000 dollars a year, while that to the apple crop is not much less, and that to the potato crop at least one-half as much. But the estimate is not a fair one until into the loss is counted the time spent in fighting to secure the proportion that is saved.

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* The idea of the modern conventionalist is, of course, to have a means of showing partner the best suit (in this case) by the discard; it does not at all trouble him that (1) you may be quite as likely to want to show him that you have no suit worth leading to; and (2) when the enemy show strength the time is better suited for lying low than for showing your partner what you hold. The lead is more than twice as likely to come from the enemy as from him.